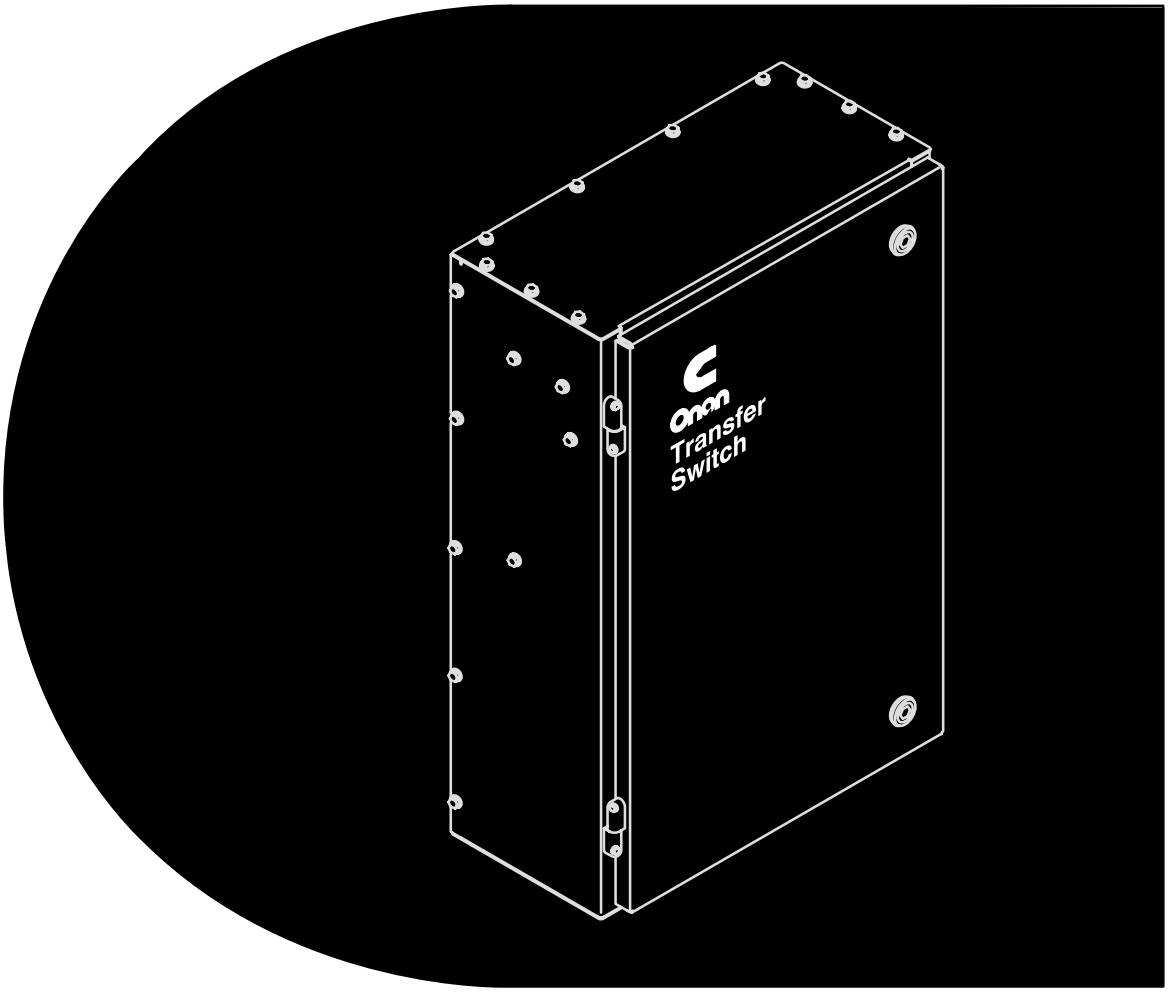
Caution: This document contains mixed page sizes (8.5 x 11 or 11 x 17), which may affect printing. Please adjust your printer settings according to the size of each page you wish to print.

Power Generation

Service Manual

RST™
Automatic Transfer Panel
60/100/200 Amperes
Utility-to-Generator Set



Printed in U.S.A.

913-0505B 9-2004

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Supplement 913−1116
Date: 12-2004
Insert with-
Titles: LT, LC, and RST Operator's, Installation and Service Manuals
Numbers: 913−0102, dated 5-1996
913−0103, dated 5-1999
913−0104B, dated 9-2004
913−0503, dated 2-1997
913−0504, dated 10-2001
913−0505B, dated 9-2004
913−0600B, dated 2-2003
913−0601, dated 2-2003
913−0602B, dated 9-2004

PURPOSE

This supplement updates the LT, LC, and RST Operator's, Installation, and Service Manuals to include information on the 5-button exercise clock available on current production units.

SUPPLEMENT USE

Write ***Refer to Supplement*** on the pages of the manuals listed above that refer to the exercise clock.

Insert this supplement inside the front cover of the manuals listed above.

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FIVE BUTTON EXERCISE CLOCKS

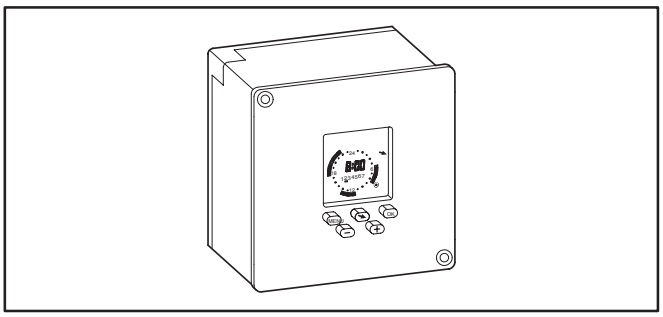


FIGURE 1. FIVE BUTTON EXERCISER CLOCK

Figure 3 shows the five operator buttons.

- The Menu button (MENU) is used to activate a menu or to break off the process.
- The Selector (Arrow) button is used to select menu topics and one of the four available modes of operation (Automatic Operation, Manual Override, Continuous Override On, and Continuous Override Off).

 NOTE: The mode symbols are not included on the right side of the display (see Figure 2). They are included in this document for reference purposes only. The button must point to the relative position of the symbol shown in this document to select the desired mode (see Figure 3).
- The OK button (OK) is used to save changes.
- The (+) and (−) buttons are used to change values.

NOTE: After one minute of button inactivity, the home menu (see Figure 2) will be redisplayed and any changes made that weren't saved by pressing the OK button will be lost.

Figure 3 also shows the following clock features.

- The available menu topics are displayed at the top of the screen.
- When being programmed, indicators for changeover (SU/Wi) and the date (D/M/Y) are displayed beneath the menu topics.
- The clock displays the time and the day of the week (1 = Monday).
- Around the clock are segments showing when an exercise period is set.
- Near the right bottom corner is a circle indicating the exercise state (black = active, white = inactive).

 NOTE: There is an audible click whenever an exercise period starts or stops.

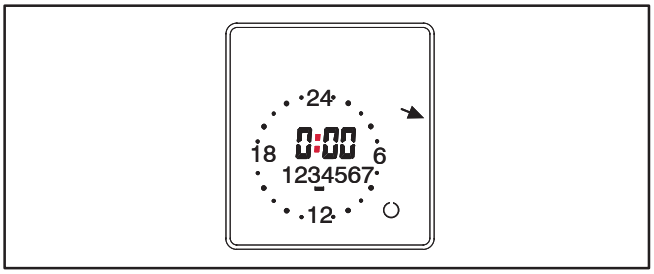


FIGURE 2. EXERCISER CLOCK HOME MENU

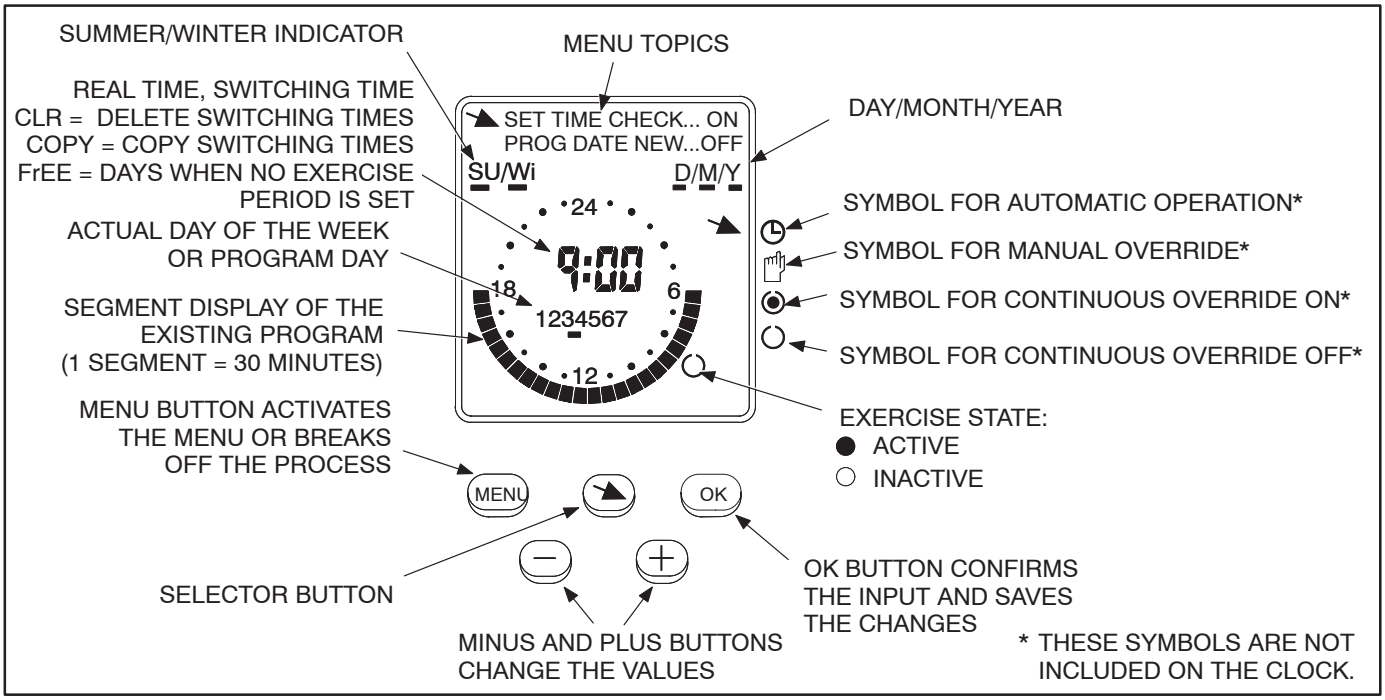


FIGURE 3. FIVE BUTTON EXERCISER CLOCK FEATURES

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To reset the exerciser clock:

The clock is not pre-programmed. The clock can be reset to erase just the existing day and time settings or it can be reset to erase all existing day, time, and exercise program settings.

- To erase just the existing day and time settings, simultaneously press the **MENU**, **+**, and **–** buttons. The screen will go blank. When the buttons are released two sets of dashes will be momentarily displayed (–– ––) and then the clock is displayed with the time set to midnight (0:00).
- To erase all existing day, time, and exercise program settings, simultaneously press all five buttons. The screen will go blank. Release the **MENU** button while continuing to press the other buttons. Two sets of dashes will be displayed (–– ––). After three seconds have passed, release the remaining four buttons. The clock is then displayed with the time set to midnight (0:00).

To set the time:

1.. With the exerciser clock powered, press the **MENU** button. Use the selector button to select **SET TIME** which is displayed in the upper left-corner of the display (see Figure 4).

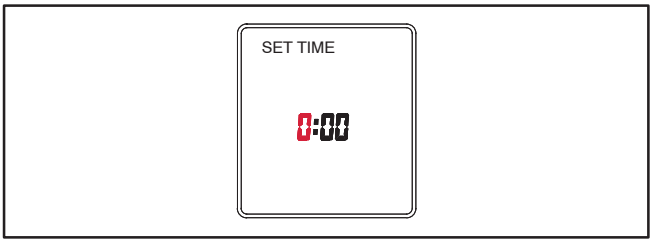


FIGURE 4. SETTING THE TIME

2.. Press the **OK** button. The word “DATE” is displayed. Press the **OK** button again. The time is displayed with the hour value flashing. The time displayed is based upon a 24 hour clock (military time).
Example: 2:00 PM = 14:00.

3.. Press the **+** or **–** buttons until the correct hour is displayed. Press the **OK** button. The minute value will then flash.

4.. Press the **+** or **–** buttons until the correct minute is displayed. Press the **OK** button. The home menu is redisplayed showing the set time (see Figure 5).

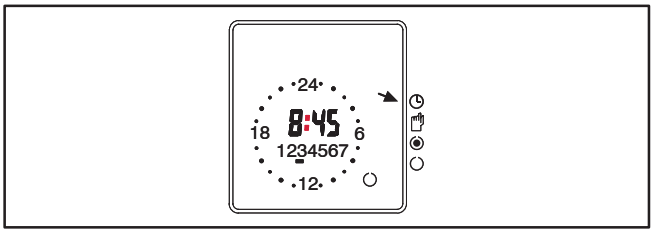


FIGURE 5. SET TIME

To set the date and summer/winter changeover:

1.. Press the **MENU** button. Use the selector button to select **SET TIME** and press the **OK** button.

2.. Press the selector button to select **DATE** and then press the **OK** button. The current year is displayed flashing and D/M/Y is displayed with the “Y” underlined (see Figure 6).

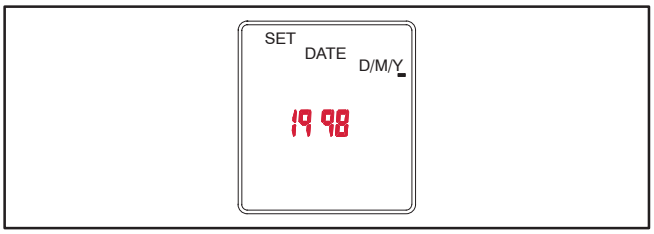


FIGURE 6. SETTING THE YEAR

3.. Press the **+** or **–** buttons until the correct year is displayed. Press the **OK** button. The day and month will then be displayed with the day flashing and D/M/Y is displayed with the “D” underlined (see Figure 7).

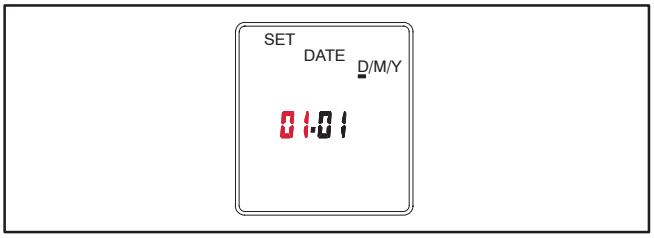


FIGURE 7. SETTING THE DAY AND MONTH

4.. Press the **+** or **–** buttons until the correct day (1 thru 31) is displayed. Press the **OK** button. The month value will then flash and D/M/Y will be displayed with the “M” underlined.

5.. Press the **+** or **–** buttons until the correct month (1 thru 12) is displayed. Press the **OK** button. The summer/winter changeover menu is displayed with the selected region flashing (see Figure 8).

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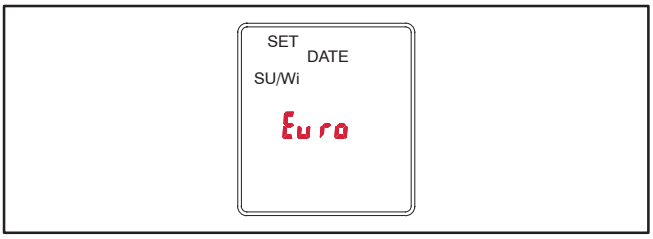


FIGURE 8. SUMMER/WINTER CHANGEOVER MENU

6.. To set the clock for summer/winter changeover (daylight savings time), press the + or – buttons to select the appropriate region (see Table 1) and then press the **OK** button. The home menu is redisplayed. The matching number for the current day of the week will be underlined.
Examples: 1 = Monday
7 = Sunday

NOTE: If you do not wish any changeover, select the nonE setting. If you wish to set changeover times different from one of the preset times, select MAn and follow the instructions included in Table 1.

TABLE 1. SUMMER/WINTER CHANGEOVER INFORMATION

Choice	Beginning of Summertime	End of Summertime	Country/ Area
Euro	Last Sunday in March	Last Sunday in October	European Union
Gb	Last Sunday in March	Last Sunday in October	Great Britian
US	First Sunday in April	Last Sunday in October	North America
nonE	No changeover	No changeover	—
MAn	Freely programmable date with regards to the change from summer to winter time. Northern Hemisphere: Use the + and – buttons to put in the date at which the summer time starts and ends at your location/in your country. The weekday is automatically allocated to the date. Southern Hemisphere: For the southern hemisphere, the date at which the summer time starts/ends must be programmed for the **same year**. Use the + and – buttons to set the year and then press the **OK** button. Use the + and – buttons to set the actual day and month of summer time and then press the **OK** button. Use the + and – buttons to set the actual day and month of real time and then press the **OK** button.		

To set exercise start and stop times:

NOTE: The start and stop time for an exercise period must both be in the same day. For example, you cannot have a 30 minute exercise period start at 23:45 on one day and stop at 0:15 on the following day.

1.. Press the **MENU** button. The selector button will pointing at **PROG**. Press the **OK** button.

2.. The selector button will be pointing at **PROG NEW**. Press the **OK** button again. “ON” is displayed in the top right corner of the screen and the first day of the week is underlined (see Figure 9).

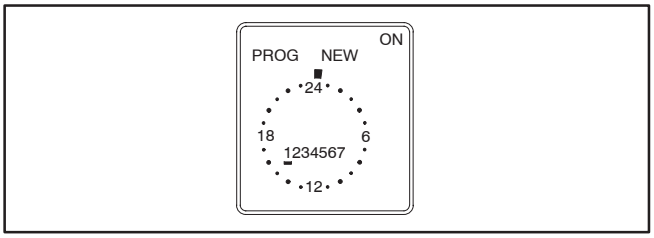


FIGURE 9. SETTING THE DAY OF THE WEEK THE EXERCISE IS TO BEGIN

3.. To select a different day, press the + or – buttons until the desired day is underlined.

NOTE: If an exercise period is already set for the selected day, the program and ***CL r*** will be displayed. If you wish to delete the set program, press the **OK** button.

4.. Press the **OK** button. The starting time (0:00) is flashed (see Figure 10).

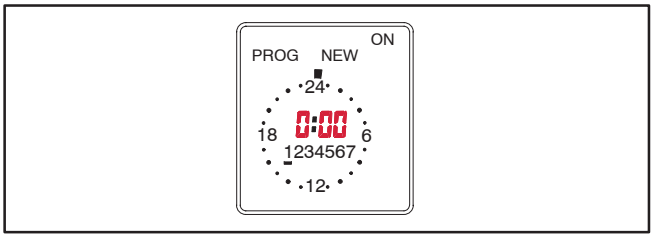


FIGURE 10. EXERCISE CLOCK MENU

5.. Press the + or – buttons to set the starting time for the exercise (see Figure 11).

NOTE: If you lightly press the + or – buttons, the value changes in one minute increments. If you press and hold the + or – buttons, the value changes in ten minute increments.

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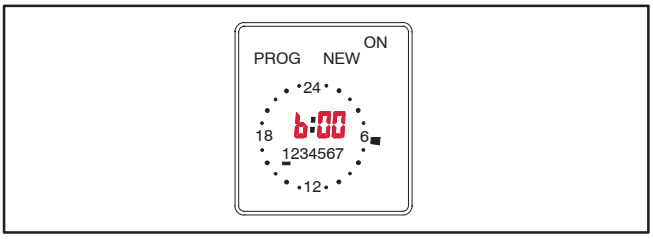


FIGURE 11. SETTING THE EXERCISE STARTING TIME

6.. Press the **OK** button. The starting time is still displayed and "OFF" is now displayed in the upper right corner of the screen (see Figure 12). Press the **+** button to set the exercise stop time.

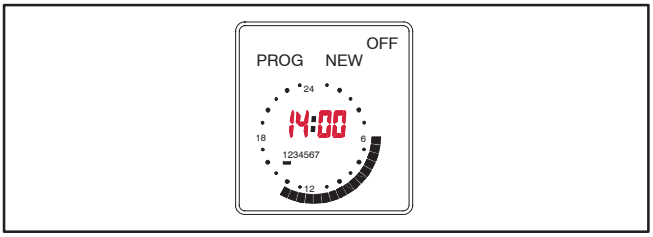


FIGURE 12. SETTING THE EXERCISE STOP TIME

7.. Press the **OK** button. Press the **OK** button again to save the exercise program.

NOTE: If the Delete Program menu is displayed (see Figure 13), ***CL r*** is displayed, indicating that the exercise program can be deleted by pressing the **OK** button.

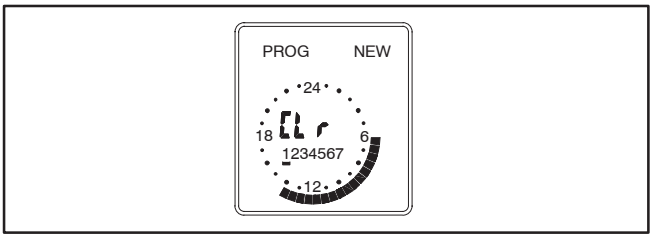


FIGURE 13. DELETE PROGRAM MENU

8.. Copy the set program, set an additional exercise period, or exit the the program input.

a. If you wish to copy the set program, see "To copy an exercise program" in the next column.

b. If you do not wish to set any additional exercise periods, press the **MENU** button until the home menu is redisplayed.

NOTE: On the day that the exercise is to become active, segments will be displayed around the clock showing when the exercise period is set (see Figure 14).

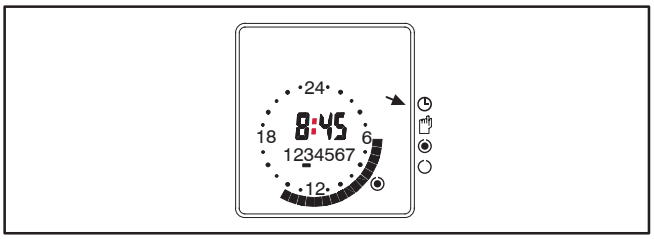


FIGURE 14. SET EXERCISE

To copy an exercise program:

1.. Once a set exercise program has been saved, press the selector button ⛅ to display the copy menu (see Figure 15).

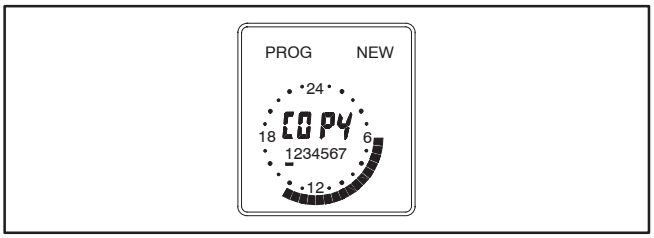


FIGURE 15. COPY EXERCISE MENU

2.. Press the **+** button to select the day of the week that you wish to include the same exercise period. Press the **OK** button.

3.. If you want the exercise to occur on additional days, repeat the copy procedure.

4.. To terminate setting exercise programs, press the **MENU** button until the home menu is redisplayed.

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To erase (delete) exercise programs:

1.. Press the **MENU** button. The selector button will pointing at **PROG**. Press the **OK** button.

2.. The selector button will be pointing at **PROG NEW**. Press the **OK** button again.

3.. Use the + or – buttons to select the day of the week that the exercise is set. When the correct day is selected, segments will be displayed around the clock showing when the exercise period is set and ***Cl r*** is displayed in the center of the clock (see Figure 16).

4.. Press the **OK** button. The clock will be reset to midnight (0:00) and new exercise settings can be entered. If you do not wish to set up a new exercise period, press the **MENU** button until the home menu is redisplayed.

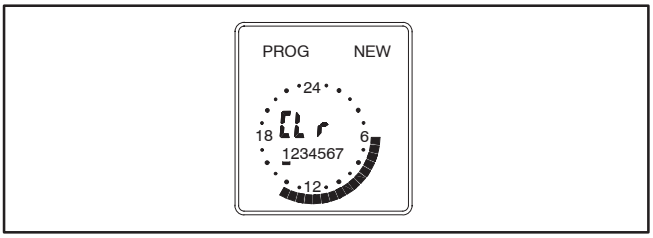


FIGURE 16. DELETING THE EXERCISE PROGRAM

To check the exercise program:

1.. Press the **MENU** button. The selector button will pointing at **PROG**. Press the **OK** button.

2.. The selector button will be pointing at **PROG NEW**. Press the selector button button again so that it points to **TIME CHECK**... Press the **OK** button.

3.. Use the + or – buttons to select the day of the week that the exercise is set to begin. Press the **OK** button.

4.. Repeatedly press the **OK** button to view the exercise starting and stop times. A clock is displayed showing the exercise start and stop times.

NOTE: If no exercise periods are set, ***FrEE*** is displayed instead of the time.

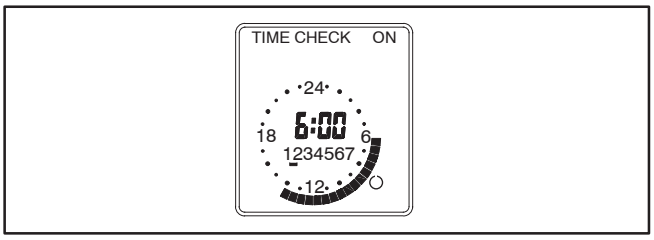


FIGURE 17. CHECKING THE EXERCISE START TIME

5.. To terminate checking the exercise program, press he **MENU** button until the home menu is redisplayed.

Permanent On/Off Mode:

The Permanent On/Off (Manual Override) mode reverses the set exercise state. It is initiated by using the selector button to select the Manual Override mode (see Figure 18). The exercise state indicator shown in the bottom right corner of the display will then be reversed.

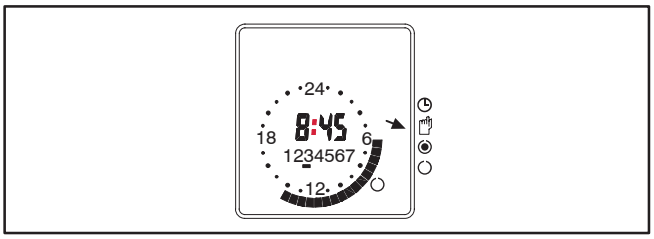


FIGURE 18. SELECTING PERMANENT ON/OFF MODE

To exit the Permanent On/Off mode, press the selector button until the Automatic Operation mode is selected. The exercise state indicator shown in the bottom right corner of the display will go back to its normal state.

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To initiate or override exercise program(s):

The exerciser clock has a built-in test feature. Once the clock time has been set, the selector button can be used to select Continuous Override ON mode ◉ to initiate a test (see Figure 19) or select Continuous Override OFF mode ○ to cancel a test in progress (see Figure 20).

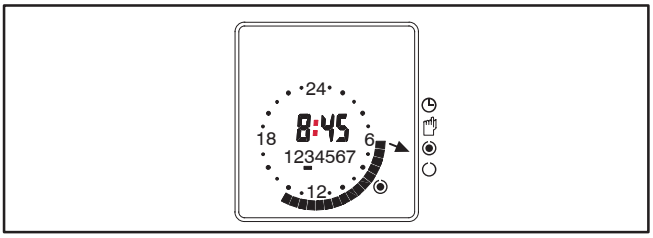


FIGURE 19. CONTINUOUS OVERRIDE ON

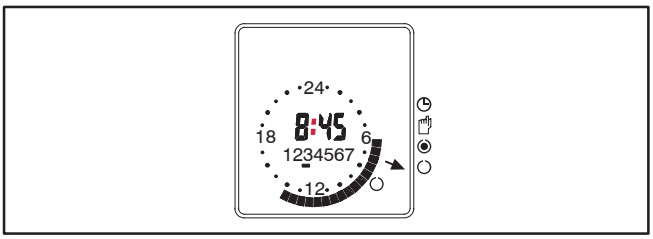


FIGURE 20. CONTINUOUS OVERRIDE OFF

To exit either mode, press the selector button until Automatic Operation mode is selected. The exercise state indicator shown in the bottom right corner of the display will go back to its normal state.

Mains Failure:

If the clock is disconnected from AC power or the AC power source fails, “no U” is displayed (see Figure 21).

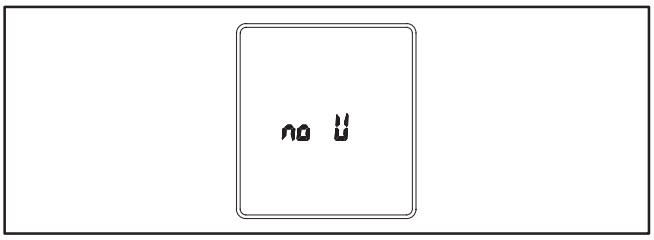


FIGURE 21. AC POWER FAILURE INDICATION

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Table of Contents

SECTION	TITLE	PAGE
	SAFETY PRECAUTIONS	**iv**
1.	**INTRODUCTION**	**1-1**
	About This Manual	1-1
	Transfer Panel Application	1-1
	Transfer Panel Function	1-1
	Transfer Panel Protection	1-2
	Removing and Replacing Electronic Control Components	1-2
	Model Identification	1-3
	RST Controls	1-4
	Mechanical Latching	1-4
2.	**DESCRIPTION AND OPERATION**	**2-1**
	General	2-1
	Component Descriptions	2-1
	Cabinet Exterior	2-1
	Connectors	2-1
	Terminal Blocks	2-1
	Transfer Switch Assembly	2-3
	Contactors	2-3
	Electronic Control Board	2-4
	Load/No Load Switch	2-4
	Cal/85% Pickup Switch (Control Package A Only)	2-4
	3-Phase/1-Phase Switch (Control Package B Only)	2-4
	Undervoltage Sensing	2-5
	Time Delays	2-5
	Float Battery Charger	2-5
	Optional Modules	2-6
	Three-Wire Starting Option	2-6
	Exerciser Clock	2-6
	Area Protection/ Remote Test Transfer	2-6
	Operation	2-7
	Automatic Operation	2-7
	Generator Set Exercise	2-7
	Generator Set Start Test	2-7
	Two-Wire Starting	2-7
	With-Load Standby System Test	2-8
	Overcrank Reset (3-Wire Start Only)	2-8
	Planned Maintenance	2-9

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Table of Contents *(Continued)*

SECTION	TITLE	PAGE
3.	**ADJUSTMENTS AND SETTINGS**	**3-1**
	Introduction	3-1
	Calibrating and Adjusting the Electronic Control	3-1
	Connect the Battery	3-1
	Connect AC Line Power	3-1
	Voltage Sensors	3-1
	Undervoltage Sensor Calibration	3-2
	Undervoltage Pickup and Dropout Adjustments (Control Package B Only)	3-3
	Time Delays	3-4
	Float Battery Charger	3-5
	Battery Charger Float Voltage	3-5
	Three-Wire Start Module (Optional)	3-6
	Exerciser Clock	3-7
	Test With Load or Without Load	3-9
4.	**TROUBLESHOOTING**	**4-1**
	Introduction	4-1
	Control System Operation	4-1
	Indicator LEDs	4-1
	Normal Power Source Connected to Load	4-2
	Normal Power Source Interrupted	4-2
	Emergency Power Source Connected to Load	4-3
	Normal Power Source Returns	4-3
	Test/Exercise With/Without Load	4-4
	Troubleshooting	4-5
5.	**TRANSFER PANEL SERVICE**	**5-1**
	Introduction	5-1
	Disconnect AC Power	5-1
	Reconnect AC Power (When Finished)	5-1
	60-Ampere Contactor Assembly Service	5-1
	Auxiliary Contacts	5-3
	Mechanical Latch Service	5-3
	Mechanical Interlock Service	5-3
	Contactor Assembly Service	5-3
	100 and 200-Ampere Contactor Assembly Service	5-5
	Auxiliary Contact Service	5-5
	Contactor Assembly Service	5-6
	Mechanical Interlock Service	5-6
	Electronic Control Circuit Board	5-6

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Table of Contents *(Continued)*

SECTION	TITLE	PAGE
6.	**SCHEMATICS/WIRING DIAGRAMS**	**6-1**
	Schematics/Wiring Diagrams	6-1
	Control Baord (Control Package A) 300-4754	6-2
	Control Board (Control Package B) 300-4750	6-3
	Transfer Panel Wiring Diagram (60 Amp)	6-4
	Transfer Panel Wiring Diagram (100 & 200 Amp)	6-8

⚠WARNING

INCORRECT SERVICE OR REPLACEMENT OF PARTS CAN RESULT IN DEATH, SEVERE PERSONAL INJURY, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.

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Safety Precautions

This manual includes the following symbols to indicate potentially dangerous conditions. Read the manual carefully and know when these conditions exist. Then take the necessary steps to protect personnel and the equipment.

⚠DANGER ***This symbol warns of immediate hazards that will result in severe personal injury or death.***

⚠WARNING ***This symbol refers to a hazard or unsafe practice that can result in severe personal injury or death.***

⚠CAUTION ***This symbol refers to a hazard or unsafe practice that can result in personal injury or product or property damage.***

High voltage in transfer panel components presents serious shock hazards that can result in severe personal injury or death. Read and follow these suggestions.

Keep the transfer panel cabinet closed and locked. Make sure only authorized service personnel have access to the cabinet.

Due to the serious shock hazard from high voltages within the cabinet, all service and adjustments to the transfer panel must be performed only by an electrician or authorized service personnel.

Instructions to Authorized Service Personnel

If the cabinet must be opened for any reason:

1. Move the operation selector switch on the generator set to OFF.

 If the transfer panel is equipped with the 3-Wire Start Option, move the toggle switch to the Stop position.
2. Remove the AC power source to the cabinet.
3. Disconnect the starting batteries of the generator set (remove the ground [−] lead first).

Place rubber insulative mats on dry wood platforms over metal or concrete floors when working on any electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling any electrical equipment.

Jewelry is a good conductor of electricity and should be removed when working on the electrical equipment.

Do not work on this equipment when mentally or physically fatigued, or after consuming alcohol or any drug that makes the operation of equipment unsafe.

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1. Introduction

ABOUT THIS MANUAL

This manual provides information necessary for service and includes models produced under the Cummins®/Onan® and Cummins Power Generation brand names.

This manual contains service procedures to service the RST transfer panel. Refer to the schematic and wiring diagram package that was shipped with the transfer panel for specific information about its configuration.

Use all normal and necessary safety precautions before starting any service procedures. Identify all hazards by referring to the Safety Precautions and observe all warnings and cautions within the manual. Whenever troubleshooting, remember that the generator set, transfer panel, and utility power source are all interdependent.

This transfer panel is available with two control packages: control package A has the standard feature set, and control package B has a higher level of features. This manual covers both control packages.

TRANSFER PANEL APPLICATION

Transfer panels are an essential part of a building's standby or emergency power system. The Normal power source, commonly the utility line, is backed up by an Emergency power source, often a generator set. The transfer panel supplies the electrical load with power from one of these two power sources.

The load is connected to the common of the transfer switch (Figure 1-1). Under normal conditions, the load is supplied with power from the Normal source (as illustrated). If the Normal power source is interrupted, the load is transferred to the Emergency power source. When Normal power returns, the load is retransferred to the Normal power source. The transfer and retransfer of the load are the two most basic functions of a transfer panel.

TRANSFER PANEL FUNCTION

Automatic transfer panels, capable of automatic operation without operator involvement, perform the following basic functions:

1. Senses the interruption of the Normal power source.
2. Sends a start signal to the generator set (Emergency power source).
3. Transfers the load the the Emergency power source
4. Senses the return of the Normal power source.
5. Retransfers the load to the Normal power source.
6. Sends a stop signal to the generator set.

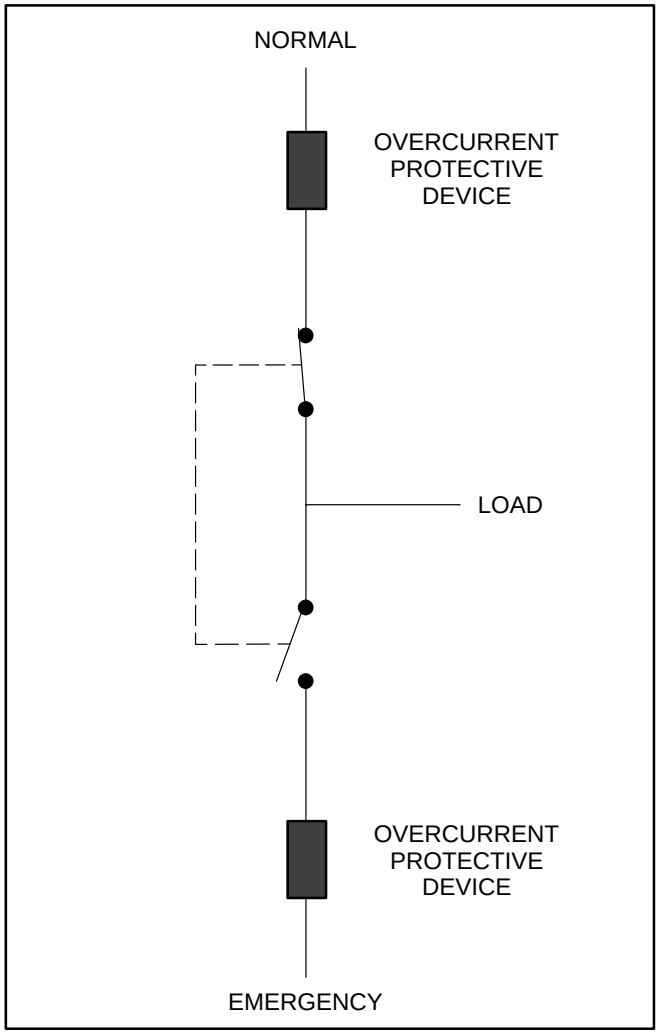


FIGURE 1-1. LOAD TRANSFER PANEL (TYPICAL FUNCTION) TRANSFER PANEL PROTECTION

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TRANSFER PANEL PROTECTION

Transfer panels are continuously rated devices. With proper maintenance, they will carry load currents up to their nameplate ratings for any time duration. Transfer panels are designed to withstand normally occurring surge currents from electrical devices in their load circuits. They are also designed to withstand the surge currents, which can occur on a short circuit or fault condition, as long as the available fault current does not exceed the rating of the switch and it's protective device, and the transfer panel is installed with proper protective equipment.

All automatic transfer panels are required to be installed with appropriate overcurrent protection on the normal source side of the transfer panel, and on the emergency source side of the panel (Figure 1-1). Protective devices may be circuit breakers, fuses, or other suitable overcurrent protective system components. A list of allowable protective equipment is affixed to the transfer switch. The listed protective device must be installed at some point in the circuit between the transfer panel and the electrical services that feed the device.

REMOVING AND REPLACING ELECTRONIC CONTROL COMPONENTS

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Disconnect connector J1/P1 before working on the electronic control system.***

Disconnecting J1/P1 removes all power to the door**.** Be sure to remove all power before replacing components.

No special tools are required to remove and replace control system components.

The transfer panel must always maintain compliance with any applicable codes and standards. Improper servicing can create an unsafe installation that might cause severe personal injury, death, and/or equipment damage.

Torque ground lugs to the values shown in Table 1-1.

TABLE 1-1. LUG TORQUE REQUIREMENTS

PANEL SIZE (AMPS)	TIGHTENING TORQUES	WIRE RANGE
Ground Lug (All)	35 in-lbs (4 N•m)	4-14 AWG CU 16-2.5mm^2
60	75 in-lbs (8.5 N•m)	2-10 AWG CU
100	80 in-lbs (9 N•m)	2/0-14 AWG CU-AL
200	275 in-lbs (31 N•m)	300 MCM-6 AWG CU-AL

⚠WARNING ***Incorrect installation, service, or replacement of parts can result in severe personal injury, death and/or equipment damage. Service personnel must be trained and experienced to perform electrical and/or mechanical component installation.***

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MODEL IDENTIFICATION

Identify your model by referring to the Model and Specification number as shown on the nameplate. Electrical characteristics are shown on the lower portion of the nameplate. The nameplate is located on the cabinet door.

For the name of your local Cummins Power Generation distributor or if you need more assistance, please call the phone number listed on the back cover of this manual during the hours of 7:30 AM to 4:00 PM, Central Standard Time, Monday through Friday.

If it is necessary to contact a dealer or distributor regarding the transfer panel, always give the complete Model, Specification, and Serial number as listed on the nameplate. This information is necessary to properly identify your unit among the many types manufactured.

Refer to the next page of this section for a list of feature/option codes for transfer panels at spec level A and above.

The model number is made up of code segments that designate various features or options:

RST	**60**	**00000**	A
1	2	3	4

1. RST - 3-Pole Transfer Panel Series
2. Ampere Rating
3. Sequentially assigned spec number - issued for each specific combination of accessories, voltages, frequency and standards codes.
4. Specification letter - advances with production modification

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RST CONTROLS

FEATURE DESCRIPTION	FEATURE NUMBER
Control	
Control Package A	C021
Control Package B	C022
Frequency	
60 Hertz	A044
Voltage	
240 VAC	R023
Phase	
System − 1 Phase, 2-W or 3-W	A041
Agency Approval	
Listing − UL	A046
Battery Charger	
Battery Charger − 2A,12/24V	K001
Mechanical Latching	
Mechanically Held Line Side	A005
After Market Option Kits	
Module, 2 − 3-Wire Start	−−−
Exerciser Clock Kit	−−−

TABLE 1-2. CONTROL FEATURES

Control Package A	Control Package B
• Time Delay Start: 3 seconds	• Time Delay Start: 0 to 15 seconds (adjustable)
• Transfer Time Delay: 3 seconds	• Transfer Time Delay: 2 to 120 seconds (adjustable)
• Retransfer Time Delay: 5 minutes	• Retransfer Time Delay: 6 seconds to 30 minutes (adjustable)
• Stop Delay: 5 minutes	• Stop Delay: 2 seconds to 10 minutes (adjustable)
• Undervoltage Sensing: Single Phase on Normal and Emergency −Pickup 85% of Nominal −Dropout 75% of Pickup	• Undervoltage Sensing: Three phase Differential Sensing on Normal, Single phase Emergency −Pickup 85 − 100% of nominal (adjustable) −Dropout: 75 − 98% of Pickup (adjustable)
• Remote Test Terminals	• Remote Test Terminals
	• 7 Day Exerciser Clock with or without load

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2. Description and Operation

GENERAL

This section describes the components, operation and maintainence of the RST transfer panel. The following descriptions cover the standard and optional features.

COMPONENT DESCRIPTIONS

Cabinet Exterior

The cabinet (Figure 2-1) meets the requirements of the National Electrical Manufacturers Association (NEMA) for a UL Type 1 Cabinet. This type is designated as a general-purpose, indoor cabinet.

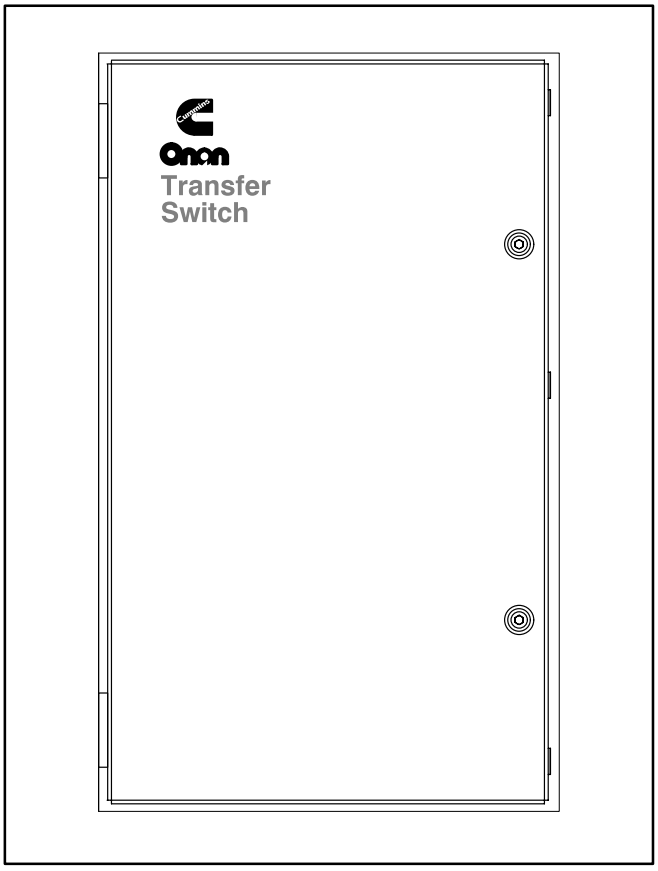


FIGURE 2-1. CABINET EXTERIOR

Connectors

Disconnecting J1/P1 (Figure 2-3) disconnects all line power from the door. Refer to sheets 2 and 4 in the schematic and wiring diagram package delivered with the unit.

Terminal Blocks

Connections of standard and optional control wiring are made at terminal blocks TB2 and TB3 (Figure 2-2). Terminal block TB1 on the electronic control is prewired.

Terminal block TB3 provides the connection terminals for the 3-Wire Start (optional).

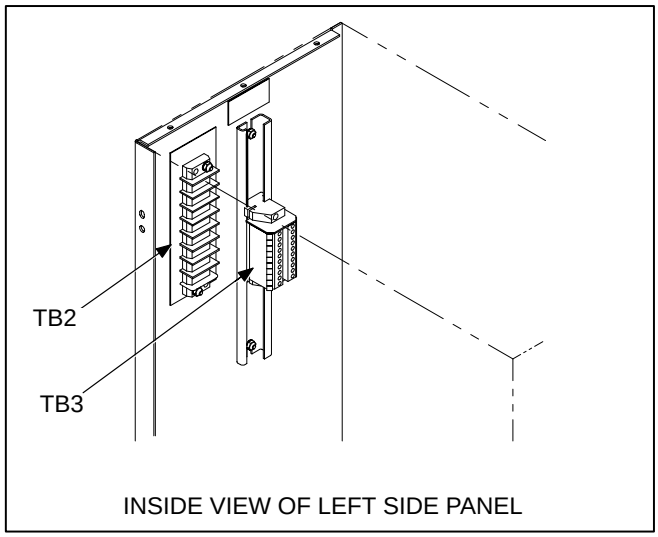


FIGURE 2-2. CONTROL WIRING CONNECTIONS

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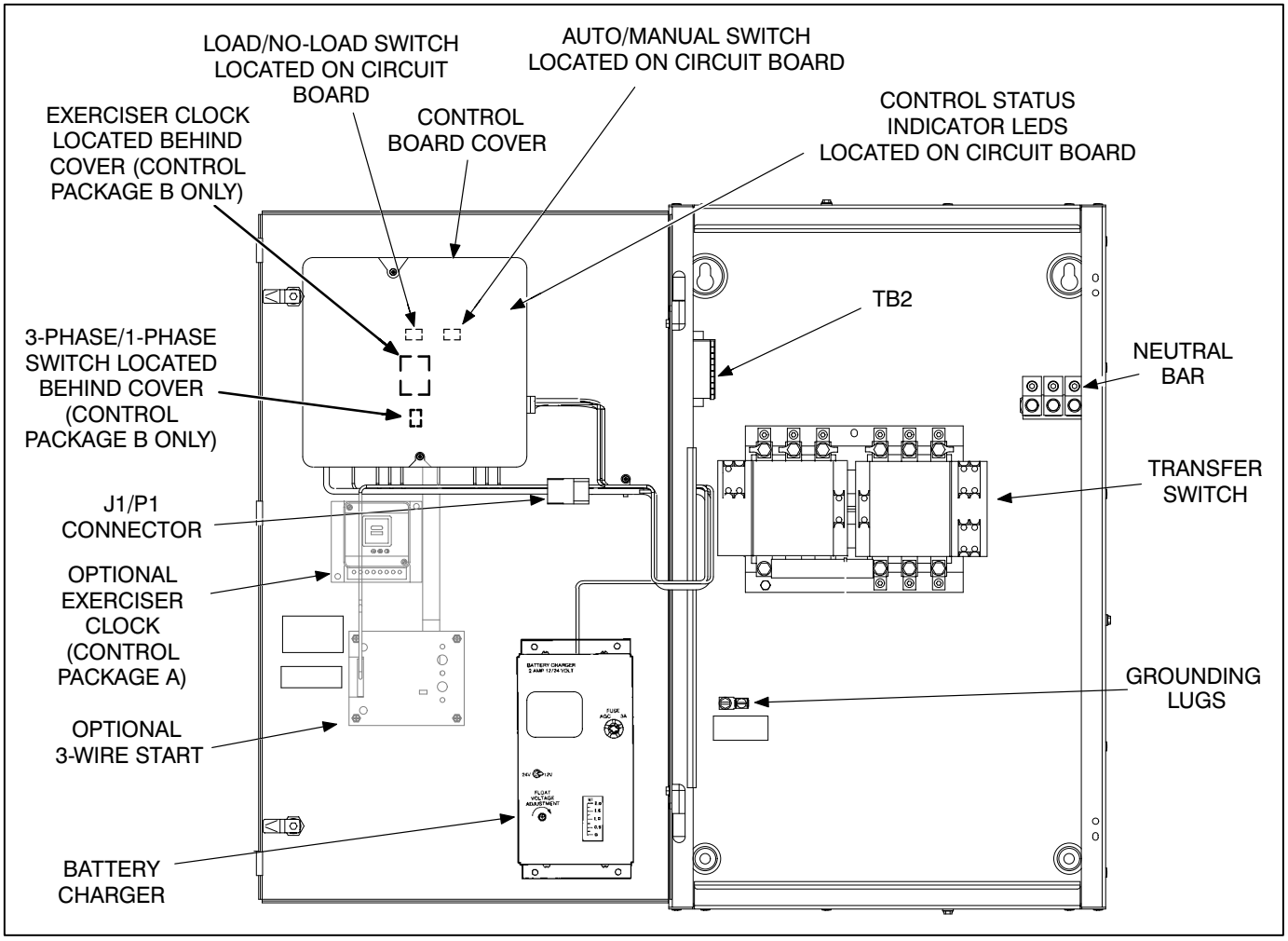


FIGURE 2-3. CABINET INTERIOR COMPONENTS

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TRANSFER SWITCH ASSEMBLY

The functions of the transfer switch are:

- to open and close the contactors that transfer the load between Normal and Emergency power
- a three pole configuration provided with a neutral bar
- controlled by signals from the control board.

The main parts of the transfer switch are contactors and auxiliary contacts.

Contactors

Two contactors make and break the current flow. When closed to the Normal power source the contacts are mechanically held. The Emergency side is electronically held. A mechanical interlock prevents contactors from closing to both power sources at the same time. Contactors are actuated by signals from the control board. See Figure 2-4.

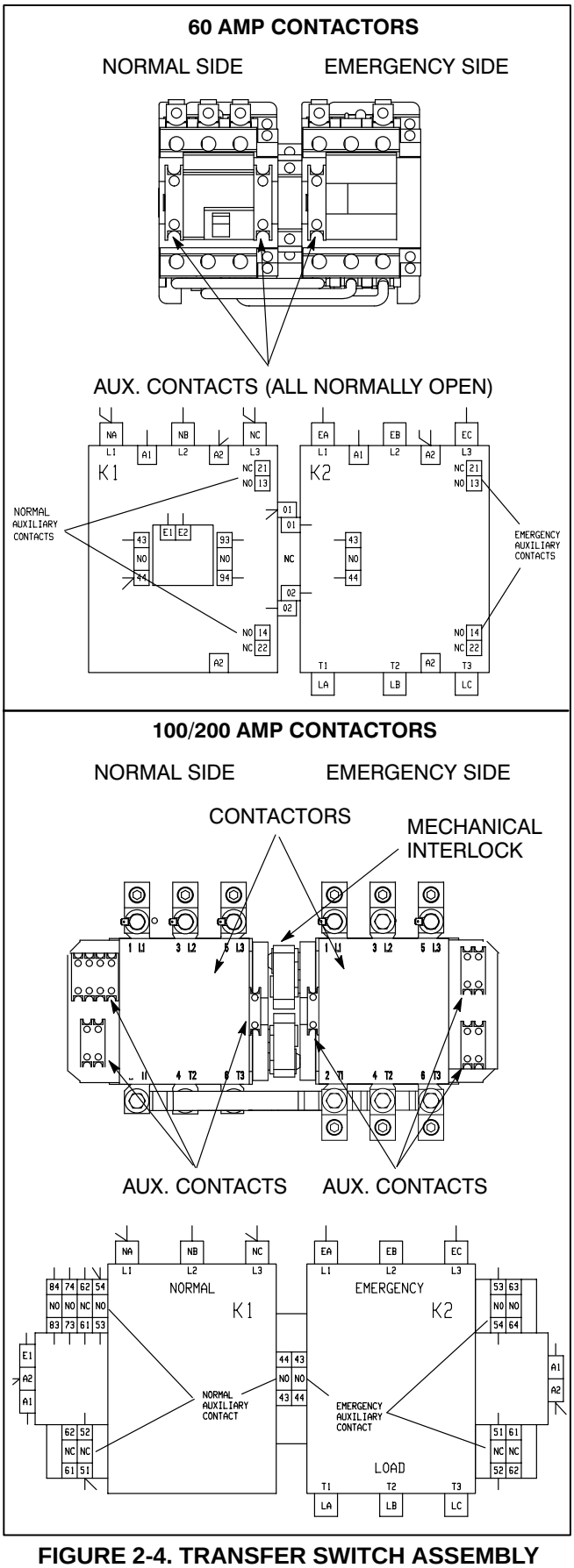


FIGURE 2-4. TRANSFER SWITCH ASSEMBLY

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ELECTRONIC CONTROL BOARD

The control board includes voltage sensing circuits, time delay circuits, control relays and status indicator LEDs. Control package B has adjustment potentiometers. The adjustments are covered in Section 3.

In the event of generator set failure, the control logic will ignore the Auto/Manual switch and initiate retransfer to utility power.

Load/No Load Switch

When the Load/No-Load switch on the control circuit board is in the Load position (Figure 2-5), a simulated power failure occurs and the load is transferred to the generator set when generator set power becomes available.

When the Load/No-Load switch is in the No-Load position, the generator set will start and run, but it will not assume the load during the remote test.

Cal/85% Pickup Switch (Control Package A Only)

When the Cal/85% Pickup switch is set in the 85% position, the voltage sensors will pickup at 85 percent voltage. The Cal setting is used for calibration (refer to Section 3 for calibration procedures). Setting the switch in the CAL position sets the voltage sensors to pickup at 100 percent.

3-Phase/1-Phase Switch (Control Package B Only)

Control package B has a 3-Phase/1-Phase switch, located on the control circuit board. When the normal source is three-phase, the switch must be set to the 3-phase position for proper voltage sensing. For a single-phase normal source, the switch must be set to 1-phase.

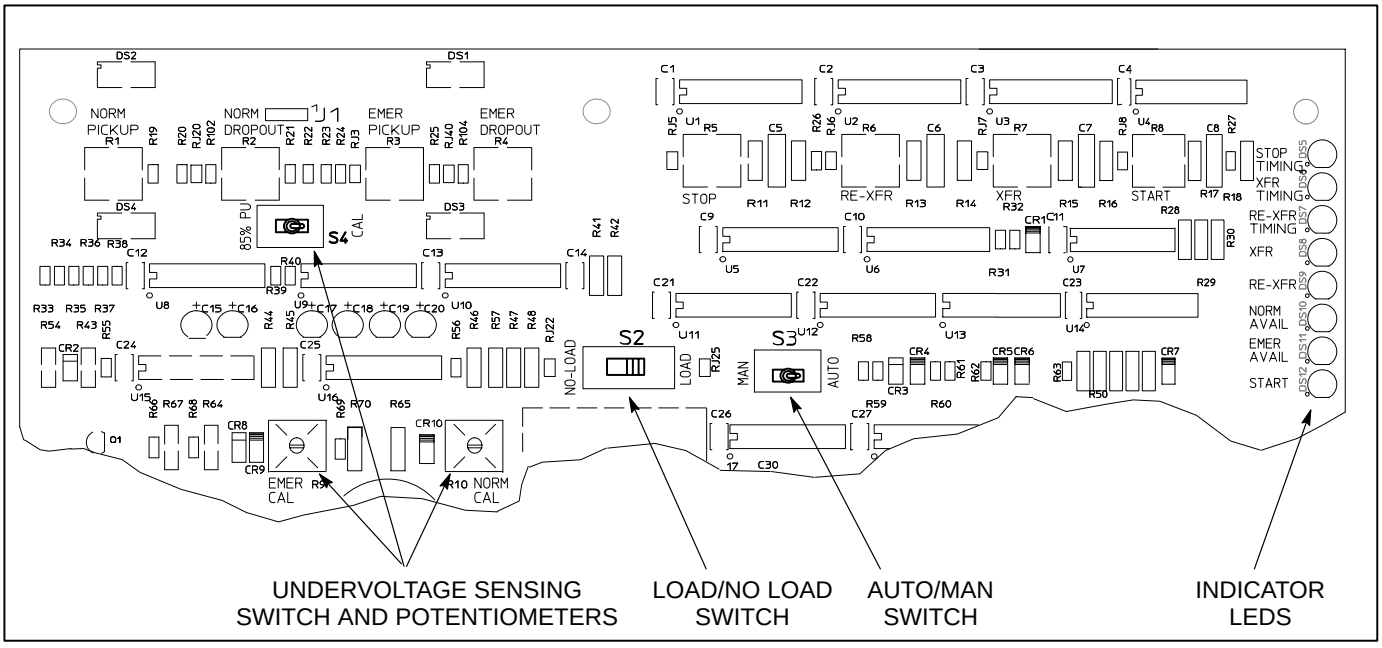


FIGURE 2-5. RST CONTROL BOARD

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Undervoltage Sensing

Voltage sensors for the Normal and Emergency side, monitor source voltages for an undervoltage condition and generate signals, which are sent to the time delays. If, for example, an under-voltage condition is sensed on the Normal source, the voltage sensor sends a signal to the time delay that initiates and controls the timing for generator set start and the transfer of load.

Control package A has undervoltage sensing for one phase of the Normal and Emergency sides with fixed pickup and dropout settings. Control package B has three phase undervoltage sensing for the Normal side and single phase sensing of the Emergency side. Control package B also has adjustable pickup and dropout settings. Refer to Section 3 for adjustment procedures.

On control package A, pickup voltage is preset to 85% of normal, and dropout is preset to 75% of pickup. On control package B, pickup is adjustable from 85% to 100% of normal, and dropout is adjustable from 75% to 98% of pickup.

Time Delays

The time delay settings on control package A are preset. The time delay settings are adjustable on control package B. Refer to Section 3 for adjustment procedures.

Start Time Delay: This delay is preset to 3 seconds on control package A and is adjustable from 0.5 to 15 seconds on control package B. This brief time delay prevents generator set starting during power interruptions of short duration. Timing starts the moment of Normal (utility) power interruption. If the duration of interruption exceeds the delay time, the control system signals the generator set to start.

Transfer Time Delay: This delay timing begins when generator voltage and frequency reach the settings of the control. After the delay, the transfer switch transfers the load to the Emergency power source. This brief time delay allows the generator set to stabilize before the load is applied. The time is preset to 3 seconds on control package A and is adjustable from 2 to 120 seconds on control package B.

Retransfer Time Delay: This delay begins the moment Normal line voltage returns. After the delay, the transfer switch can retransfer the load to the Normal source. The delay allows the Normal source to stabilize before retransfer. The time is preset to 5 minutes on control package A and it is adjustable from 6 seconds to 30 minutes on control package B.

Stop Time Delay: This delay is preset to 5 minutes on control package A and is adjustable from 2 seconds to 10 minutes on control package B. It begins timing when the load is retransferred to the Normal power source. At the end of the delay, the stop signal is sent to the generator set. This time delay allows the generator set to cool down at no load before stopping.

Float Battery Charger

The float-charge battery charger regulates its charge voltage to continuously charge without damage to the battery. As the battery approaches full charge, the charging current automatically tapers to zero amperes or to steady-state load on the battery.

The battery charger is rated for 2 amperes at 12 or 24 VDC and contains an ammeter to indicate charging current and a fuse to protect the battery charger circuit.

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OPTIONAL MODULES

Three-Wire Starting Option

The optional three-wire starting control enables the transfer panel to start and stop a three-wire start generator set. Three-wire starting logic is similar to a single-pole, double-throw switch. A common is closed to one side to send a start signal, and to the opposite side to send a stop signal. In addition to start and stop functions, the control has an overcrank relay, a preheat relay, two Timing lamps, a Lockout lamp, a Reset switch, a preheat delay On/Off switch, and an Auto/Stop/Handcrank switch.

Exerciser Clock

The exercise clock is optional on RST Transfer Panels with control package A and is standard equipment on RST Transfer Panels with control package B.

The exerciser clock is used to start and run the generator set at programmable intervals and for selected durations. It is a 7-day, 24-hour clock that can store and execute up to four start/stop programs per day. The exerciser clock also has a test feature that can be used to initiate a genset start and run cycle.

Refer to Section 3 for programming information.

Area Protection/ Remote Test Transfer

The transfer panel may, at the owner's discretion, be wired with a remote test switch. Closure of a set of contacts across the remote test inputs (terminals 7 and 8 of TB2) initiates the transfer panel test mode. During remote test a start signal is sent to the generator set.

If the Load/No-Load switch on the control circuit board is in the LOAD position (Figure 2-5), a simulated utility power failure occurs. The load is transferred to the generator set when generator set power becomes available.

If the Load/No-Load switch is in the NO-LOAD position, the generator set will start and run, but it will not assume the load during the remote test.

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OPERATION

Automatic Operation

The basic operation of the transfer panel is automatic and does not require operator involvement. The transfer panel automatically starts the genset on interruption of Normal power and transfers the load circuit when proper genset voltage is reached.

When Normal power is restored, the transfer panel automatically transfers the load back to the Normal source and stops the genset.

For automatic operation, place control switches in the positions given below.

- **Load − No Load Switch:**
 Load position.
- **Operation Selector Switch (engine control):**
 Remote position. (Two-wire start only.)
- **Stop/Auto/Handcrank Switch (Optional):**
 Auto position. (Three-wire start only.)

The generator set must also be set for automatic operation.

Generator Set Exercise

Run the generator for at least 30 minutes once each month with at least 50 percent load (if possible). If the panel is not equipped with the exerciser clock kit option, manually start the generator from the control panel on the genset.

The optional exerciser clock has programmable exercise periods that will exercise the generator set automatically with or without load, depending on the position of the Load/No-Load switch. If the Normal power source has an interruption while the generator set is exercising without load, the automatic transfer panel will transfer the load to the generator set.

Generator Set Start Test

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts whenever the cabinet door is open. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform.***

1. Place the Load/No-Load selector switch, on the control (Figure 2-3), in the No-Load position.

 The Load/No-Load selector switch must be in the No-Load position.

2. Close the cabinet door.

 ⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Close and lock the cabinet door when not working inside cabinet.***

3. Activate the remote test input. The generator set should start and run.

 At the end of the test period, deactivate the remote test input. The generator will stop.

4. In anticipation of scheduled or automatic generator set exercise, check that the Load/No-Load selector switch is in the desired position (Figure 2-3). Refer to *Generator Set Exercise.* Close and lock the cabinet door.

Two-Wire Starting

1. Move the selector switch on the engine control to RUN. The generator set should start and run.

2. Move the selector switch to OFF. The generator set should stop. Return the selector switch to Remote for automatic operation.

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With-Load Standby System Test

1. Move the Load/No-Load switch on the control circuit board to the Load position (Figure 2-5).

2. Keep the Auto/Man switch in the Auto position at all times to enable the automatic retransfer function.

3. Replace the cover over the circuit board and close the cabinet door.

 ⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Close and lock the cabinet door when not working inside cabinet.***

4. Notify occupants prior to removing utility power.

5. Turn off any electronic devices, computers etc. prior to removing utility power.

 If the standby power is supporting all circuits within the home, turn off any electronic appliances and reduce other loads until the total load does not exceed 80% of the generator's kW rating.

6. Remove the AC utility power to the tranfser panel.

 If the transfer panel is wired to a secondary distribution panel, open the breaker(s) in the main distribution panel that supply utility power to the transfer panel.

7. Activate the remote test input. The generator set should start and assume the load after the start and transfer time delays.

 At the end of the test period, deactivate the remote test input and restore the AC utility power. The generator will stop after the retransfer and stop time delays.

Overcrank Reset (3-Wire Start Only)

An overcrank condition exists when the generator set fails to start within the overcrank time limit. When this condition occurs, the Lockout lamp on the 3-Wire Start module will light. To reset the automatic starting circuit:

1. Correct the engine starting problem.

2. Push the Overcrank Reset button inward and release to reset the overcrank relay.

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PLANNED MAINTENANCE

Performing the yearly maintenance procedures in Table 2-2 will help achieve operational reliability of the transfer panel. The following procedures must only be performed by technically qualified personnel, following the procedures provided in the Service manual (913-0505). **If repair or replacement of components is necessary, call your dealer or distributor.**

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. In addition, incorrect installation, service, or parts replacement can result in severe personal injury, death, and/or equipment damage. Therefore, all corrective service procedures must only be performed by trained and experienced personnel, following the procedures provided in this manual.***

⚠WARNING ***The transfer panel presents a shock hazard that can cause severe personal injury or death unless all AC power is removed. Be sure to move the generator set operation selector switch to Stop, disconnect AC line power, disconnect the battery charger from its AC power source, and disconnect the starting battery (negative [−] lead first) before servicing.***

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any spark, arc, or flame while servicing batteries.***

TABLE 2-2. ANNUAL MAINTENANCE

1. BEFORE SERVICING: DISCONNECT ALL SOURCES OF AC POWER

Disconnect both AC power sources from the transfer panel before continuing.

a. Turn the generator set operation selector switch to OFF.
(The selector switch is located on the generator set control panel.)

b. ***Disconnect the battery charger from its AC power source.***

c. Then disconnect the set starting battery (negative [−] lead first).

2. CLEAN

a. Thoroughly dust and vacuum all controls, switching mechanism components, interior buswork, and connecting lugs.

b. Close the cabinet door and wash **exterior** surfaces with a damp sponge (mild detergent and water). ***Do not allow water to enter the cabinet, especially at lamps and switches.***

3. INSPECT

a. Check buswork and supporting hardware for carbon tracking, cracks, corrosion, or any other types of deterioration. If replacement is necessary, call your dealer or distributor.

b. Check stationary and movable contacts. If contact replacement is necessary, the procedures are described in Section 4 of this manual.

c. Check system hardware for loose connections. Tighten as indicated in Step 4.

d. Check all control wiring and power cables (especially wiring between or near hinged door) for signs of wear or deterioration.

e. Check all control wiring and power cables for loose connections. Tighten as indicated in step 4.

f. Check the cabinet interior for loose hardware. Tighten as indicated in Step 4.

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TABLE 2-2. ANNUAL MAINTENANCE (Continued)

4. PERFORM ROUTINE MAINTENANCE

a. Tighten buswork, control wiring, power cables, and system hardware, as necessary. Hardware torque values are given in Section 4 of this manual. Retorque all cable lug connections. Lug torque requirements are listed in Section 1 of this manual.

5. CONNECT AC POWER AND CHECK OPERATION

a. Connect the set starting battery (negative [−] lead last). Connect the normal AC power source, enable the backup power source. If applicable, connect power to the battery charger.

b. Verify proper operation of the battery charger.

c. Test system operation as described in this section. Close and lock the cabinet door.

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3. Adjustments and Settings

INTRODUCTION

This section provides information on calibrating and adjusting the electronic control. Adjusting the settings on the optional components and programming the exerciser clock are also covered in this section.

CALIBRATING AND ADJUSTING THE ELECTRONIC CONTROL

The adjustment pots for undervoltage and time delay settings on control package B are shown in Figure 3-1.

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts whenever the cabinet door is open. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform.***

Connect the Battery

Make sure that the RUN switch on the generator is in the OFF position. Connect the battery (negative [−] lead last). Reconnect the external battery charger.

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any arc, spark, or flame while servicing batteries.***

Connect AC Line Power

1. Connect AC line power to the automatic transfer panel.

2. Remove the cover over the control board.

The Normal Available and Normal Connected LEDs will light if the voltage sensors are calibrated.

Voltage Sensors

Control package A has undervoltage sensing for one phase of the Normal and Emergency sides with fixed pickup and dropout settings. The Pickup voltage is preset to 85% of Normal, and Dropout is preset to 75% of Pickup.

Control package B control has three phase undervoltage sensing for the Normal side and single phase sensing of the Emergency side. This control has adjustable pickup and dropout settings. Pickup is adjustable from 85% to 100% of Normal, and Dropout is adjustable from 75% to 98% of Pickup. The adjustment procedure is described in the following section.

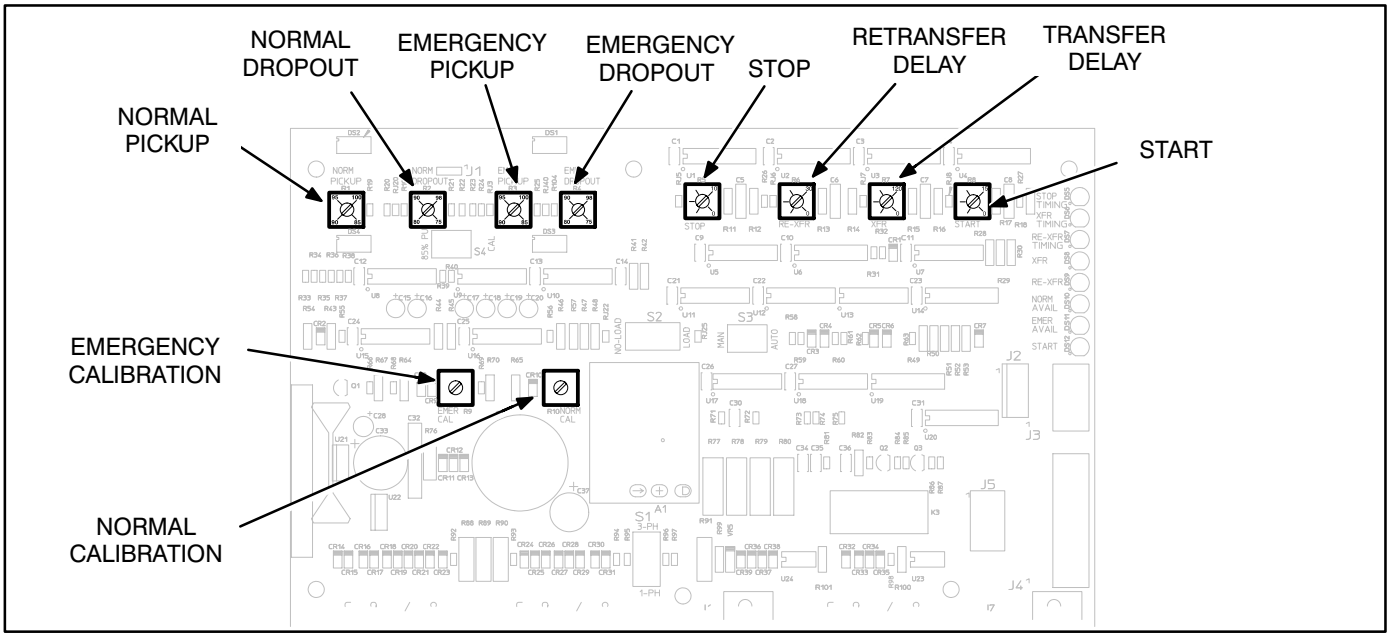


FIGURE 3-1. CONTROL PACKAGE B ADJUSTMENTS

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Undervoltage Sensor Calibration

⚠ CAUTION ***Incorrect setting of the calibration (Cal) adjustments will result in abnormal operation of the transfer panel.***

⚠ WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts whenever the cabinet door is open. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform.***

All adjustments are made by turning the appropriate potentiometer with a screwdriver. The adjustment potentiometers are accessed by removing the cover from the control.

A separate voltage sensor is used for each power source. The adjustment pot locations are shown in Figure 3-2. The Normal sensor monitors the Normal (utility) power source. The Emergency sensor monitors the Emergency (generator set) power source.

The voltage sensors monitor the Normal and Emergency power sources for an undervoltage condition.

To calibrate the undervoltage sensors:

Control Package A

1. Check that nominal voltage is present on all phases of the source being calibrated (Normal and Emergency).
2. Move the calibration switch (Figure 3-2) to the CAL position. Turn the Normal or Emergency calibration potentiometer fully counterclockwise.
3. Slowly turn the Normal or Emergency calibration (Cal) potentiometer counterclockwise until the Source Available LED corresponding to the source sensor being calibrated turns ON.
4. The undervoltage sensor is now calibrated. Repeat this procedure for the other source.
5. Move the calibration switch to the 85% position. This sets the sensor to 85% pickup and 75% dropout.

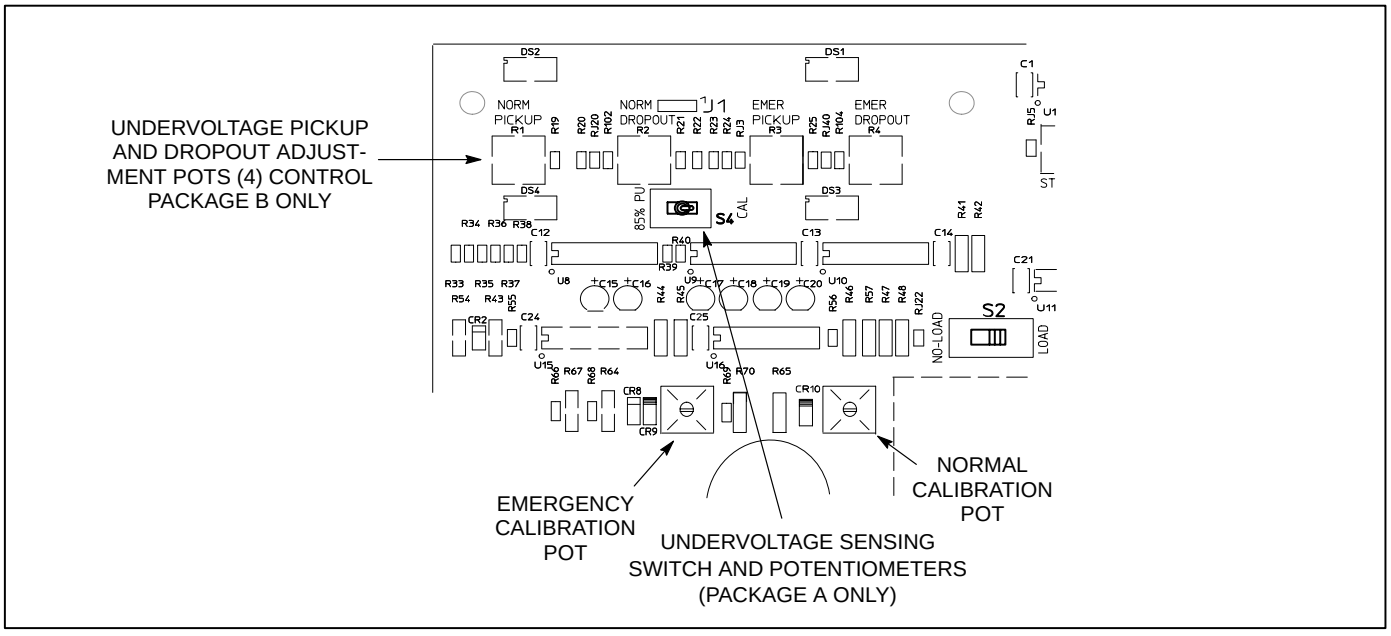


FIGURE 3-2. UNDERVOLTAGE CALIBRATION

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Control Package B

1. Check that nominal volatage is present on all phases of the source being calibrated (Normal and Emergency).
2. Perform the following for the Normal source undervoltage sensor:
 a. Turn the Normal Pickup pot (Figure 3-2) fully clockwise to 100% pickup.
 b. Turn the Normal calibration (Cal) pot fully counterclockwise.
 c. Turn the Normal Dropout pot fully clockwise to 97% dropout.
3. Turn on Normal source and check for nominal voltage.
4. Slowly turn the Normal calibration (Cal) potentiometer clockwise until the Normal Available lamp just turns ON.
5. Perform the following for the Emergency source undervoltage sensor:
 a. Turn the Emergency Pickup pot fully clockwise to 100% pickup.
 b. Turn the Emergency calibration (Cal) pot fully counterclockwise.
 c. Turn the Emergency Dropout pot fully clockwise to 97% dropout.
6. Turn on Emergency source and check for nominal voltage.
7 Slowly turn the Emergency calibration (Cal) potentiometer clockwise until the Emergency Available lamp just turns ON.
8. Turn off both power sources.

Proceed to Undervoltage Pickup and Dropout Adjustments.

Undervoltage Pickup and Dropout Adjustments (Control Package B Only)

Undervoltage dropout occurs when an undervoltage condition is sensed. Pickup occurs when an acceptable voltage is sensed. Undervoltage dropout and pickup are preset on control package A. Undervoltage dropout and pickup are adjustable over the following ranges on control package B:

FUNCTION	ADJUSTMENT RANGE
Pickup	85% to 100% of nominal voltage
Dropout	75% to 98% of pickup voltage

To set the pickup and dropout percentages, align the slots on the potentiometers with the desired markings as shown in Figure 3-2).

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TIME DELAYS

The time delay controls the following functions:

- Start time delay
- Stop time delay
- Transfer time delay
- Retransfer time delay

The time delays on control package A are preset as follows:

Start	3 seconds
Stop	5 minutes
Transfer	3 seconds
Retransfer	5 minutes

The time delays on control package B are adjustable over the following ranges:

Start	0 to 15 seconds
Stop	0 to 10 minutes
Transfer	0 to 120 seconds
Retransfer	0 to 30 minutes

To set the time delays, align the slots on the potentiometers with the desired markings (see Figure 3-3).

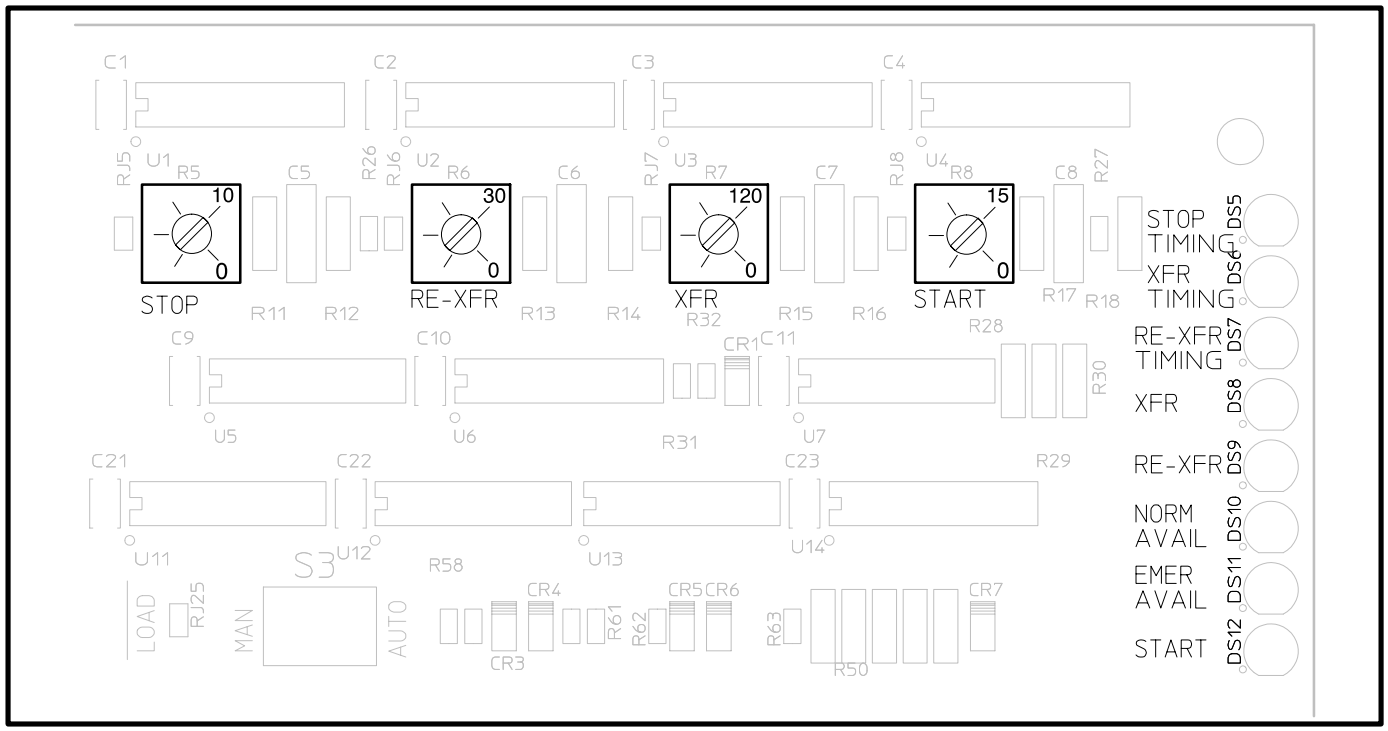


FIGURE 3-3. CONTROL PACKAGE B TIME DELAY ADJUSTMENT

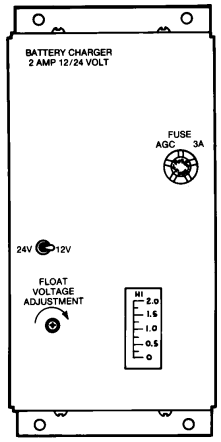
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FLOAT BATTERY CHARGER

The float-charge battery charger (Figure 3-4) regulates its charge voltage to continuously charge the battery. As the battery approaches full charge, the charging current automatically tapers to zero amperes or to steady-state load on the battery.

The battery charger is rated for 2 amperes at 12 or 24 VDC and has an ammeter to indicate charging current and a fuse to protect the battery charger circuit.

Power to the battery charger is supplied directly from the Normal source through connector J6/P6. The output of the battery charger is connected to the GND and B+ terminals of TB2 (or TB3 if the 3-Wire Start module is used). Refer to sheets 2 and 4 of the schematic and wiring diagram package.



2-AMP CHARGER

FIGURE 3-4. BATTERY CHARGER

Battery Charger Float Voltage

The float voltage is set at the correct value at the factory and should not require adjustment. However, if the battery shows signs of being overcharged or undercharged, the float voltage can be adjusted. A high specific gravity, bubbling of electrolyte, and loss of water indicate a high float voltage. A low specific gravity indicates a low float voltage.

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any spark, arc, or flame while servicing batteries.***

To check and adjust the float voltage, the following tools are needed:

- a fully charged test battery
- a hydrometer
- a small screwdriver
- an accurate voltmeter (0.5% accuracy

Checking the voltage: Use the following procedures to check the float voltage.

⚠CAUTION ***Attempting to adjust or test the battery charger with a deeply discharged battery can lead to the false conclusion that the charger is malfunctioning. Always use a fresh, fully charged battery when adjusting or testing the charger.***

⚠CAUTION ***Always disconnect the battery charger from its AC source (remove the charger's AC input fuses) before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage DC control circuits.***

1. Turn the operation selector switch for the generator set to OFF and disconnect the starting battery (negative [−] lead first).

 The selector switch is located on the generator set control panel on two-wire start systems and on 3-Wire Start module on three-wire start systems.

2. Connect the fully charged battery (negative [−] lead last) to the generator set and verify the charge condition with the hydrometer.

 A fully charged lead-acid battery will have a specific gravity of 1.260 at 77° F (25° C).

3. Connect the voltmeter directly to the battery terminals and measure the voltage.

4. Compare the voltage reading with the value shown in Table 3-3. If the voltage is above or below the recommended float voltage, open the cabinet door and adjust as specified in Step 1. If the voltage is correct, proceed to Step 3.

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TABLE 3-3. BATTERY FLOAT VOLTAGES

Lead-Acid Batteries	
Battery Voltage	**Float Voltage**
12	13.3
Nickel-Cadmium Batteries	
Float Voltage Charge Per Cell 1.38 to 1.45 volts Example: Float charge for 10 cell battery should be 13.8 to 14.5 volts.	

Adjusting the float voltage:

1. Use a small screwdriver to turn the adjustment potentiometer (located on charger panel) counterclockwise to decrease the float voltage and clockwise to increase the float voltage. Adjust in small steps and wait five minutes for the voltage to stabilize before making additional adjustments.

 ⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use care when making adjustments to avoid touching electrical contacts. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform.***

2. When adjustments are complete, close and lock the transfer panel cabinet door.

3. Disconnect the voltmeter from the battery terminals and disconnect the test battery (negative [−] lead first) from the generator set.

4. Reconnect the generator set starting battery (negative [−] lead last) and place the operation selector switch in the Auto (three-wire start) or Remote (two-wire start) position.

THREE-WIRE START MODULE (OPTIONAL)

The Three-Wire Start module has two adjustable timers.

The *Preheat timer* delays the start signal to allow preheating the generator set. The Preheat timer's range of adjustment is 0 to 60 seconds.

If a preheat delay is desired, make sure that the Preheat timer's On/Off switch is in the On position.

The *Overcrank timer* limits the time that the generator set starter is allowed to operate. The Overcrank timer's range of adjustment is 0 to 120 seconds.

To set the timers, align the slots on the potentiometers with the desired markings on the faceplate (Figure 3-5).

The Auto/Handcrank/Stop switch has three positions that function as follows:

Auto: Allows the generator set to start and assume the load if a power outage occurs. **This is the normal operating position.**

Stop: Shuts down the generator set and prevents it from starting. **Use this position when servicing the generator set.**

Handcrank: Prevents the automatic transfer switch from starting the generator set, but allows starting and stopping at the set. **Use this position for generator set maintenance.**

Connections for the optional Three-Wire Start module are made at TB3.

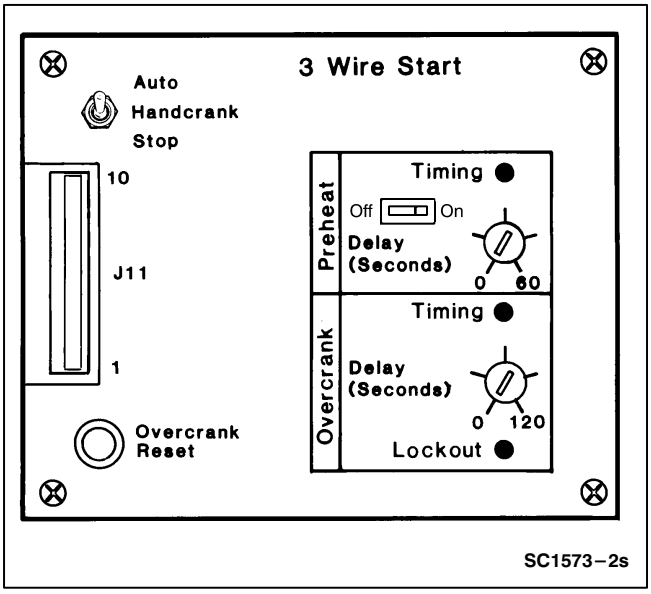


FIGURE 3-5. THREE-WIRE START MODULE

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EXERCISER CLOCK

The exercise clock is optional on RST Transfer Panels with control package A and is standard equipment on RST Transfer Panels with control package B.

The exerciser clock is used to start and run the generator set at programmable intervals and for selected durations. It is a 7-day, 24-hour clock that can store and execute up to four start/stop programs per day (one minute minimum duration). The exerciser clock also has a test feature that can be used to initiate a genset start and run cycle.

Programming the exerciser clock requires setting the time of day and entering the exercise start and stop times as described in the following sections. The exerciser clock has backup power for approximately six hours. After six hours the day and time will have to be reset. Exercise programs will not be lost during a power outage (exercise programs are stored in EEPROM).

To reset the exerciser clock program:

Resetting the exerciser clock erases all existing day, time and exercise program settings.

Depress and hold the arrow, plus and set buttons (→) (**+**) (◗) simultaneously. Release the plus and set buttons while continuing to hold the arrow button. When all aspects of the LCD display appear, release the arrow button.

To set the day and time:

1. With the exerciser clock powered, press all three buttons simultaneously to reset the time. The time display area will show (− − : − −) and a small clock symbol will appear in the upper left-corner of the display. Refer to Figure 3-6.

2. Press the arrow (→) button once to set the day-of-week. The clock symbol will begin flashing to indicate the clock is being programmed and the display will show midnight (0:00).

3. Press the plus (**+**) button as many times as necessary until the current day-of-week is displayed.
 Example: 1 = Monday, 2 = Tuesday, etc.

4. Press the arrow (→) button again to set the hour of the day. The clock uses 24-hour (military) time.

5. Press the plus (**+**) button until the current hour is displayed.
 Example: 2:00 PM is 14:00.

6. Press the arrow (→) button again to set the minutes.

7. Press the plus (**+**) button until the current minutes are displayed.
 Note that by holding the plus (**+**) button down, the minutes will increment in 5 minute intervals.

8. To set or change the exercise program, press the arrow (→) button again and go to step two in the following section. To return to the normal operating mode, press the arrow (→) button eight times (clock symbol appears in the display).

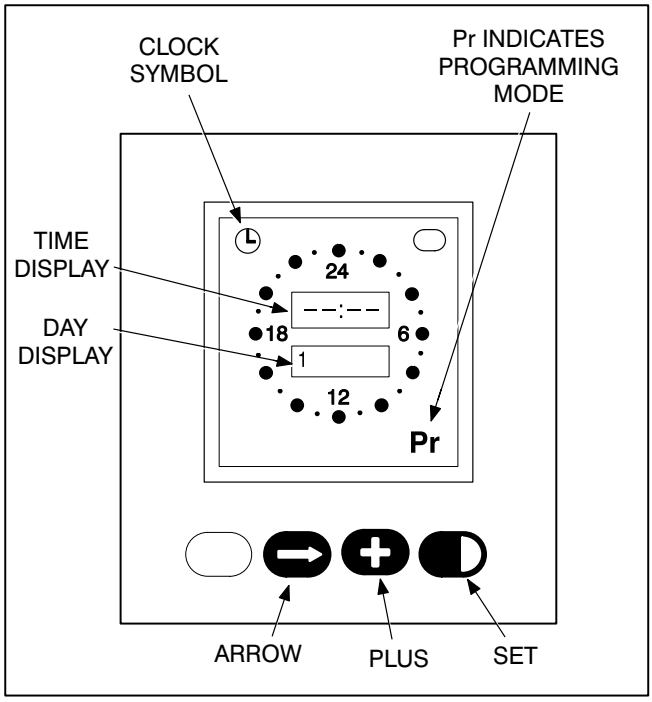


FIGURE 3-6. EXERCISER CLOCK

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To set the exercise start and stop time:

1. Press the arrow (→) button four times to start the programming mode.

2. The letters **Pr** will appear in the lower right hand corner of the display when the programing mode is reached (**Pr** will be flashing if there are no existing programs).

 Press the arrow (→) button as many times as necessary to advance to the day to be programmed.
 To clear an existing program for the day selected, press the plus and set (**+**) (◗) buttons at the same time.

3. Press the plus (**+**) button to increment the **Start** time of the exercise program. The display will show midnight (0:00). Note that by holding the (**+**) button down, the minutes increment in 15 minute intervals. When the **Start** time is reached, press the set (◗) button (ON Mode is indicated, Figure 3-7).
 Then increment the time with the plus (**+**) button to the desired **Stop** time. When the **Stop** time is reached, press the set (◗) button (OFF Mode is indicated, Figure 3-7).
 Example to exercise the genset one hour:
 Set Start at 7:00 PM (19:00)
 Set Stop at 8:00 PM (20:00)
 Note that the exercise time is indicated by a band of segments illuminated around the outer ring of the clock from the start to the stop time.

 To clear the program, press the plus and set (**+**) (◗) buttons at the same time.

4. Pressing the arrow (→) button advances to the next day. The program is copied to the next day if the next day does not have an existing program.

 To change or clear the program, press the plus and set (**+**) (◗) buttons at the same time.

 Double check the program setting for each day. Press the arrow (→) button repeatedly until the clock mode is passed and the program mode (Pr) is reached. Carefully check each days program and clear any unwanted programs.

5. When finished programming, press the arrow (→) button until the clock appears in the upper left corner of the display.

During the exercise period, the ON mode is indicated in the ellipse in the upper right corner of the display (Figure 4-8).

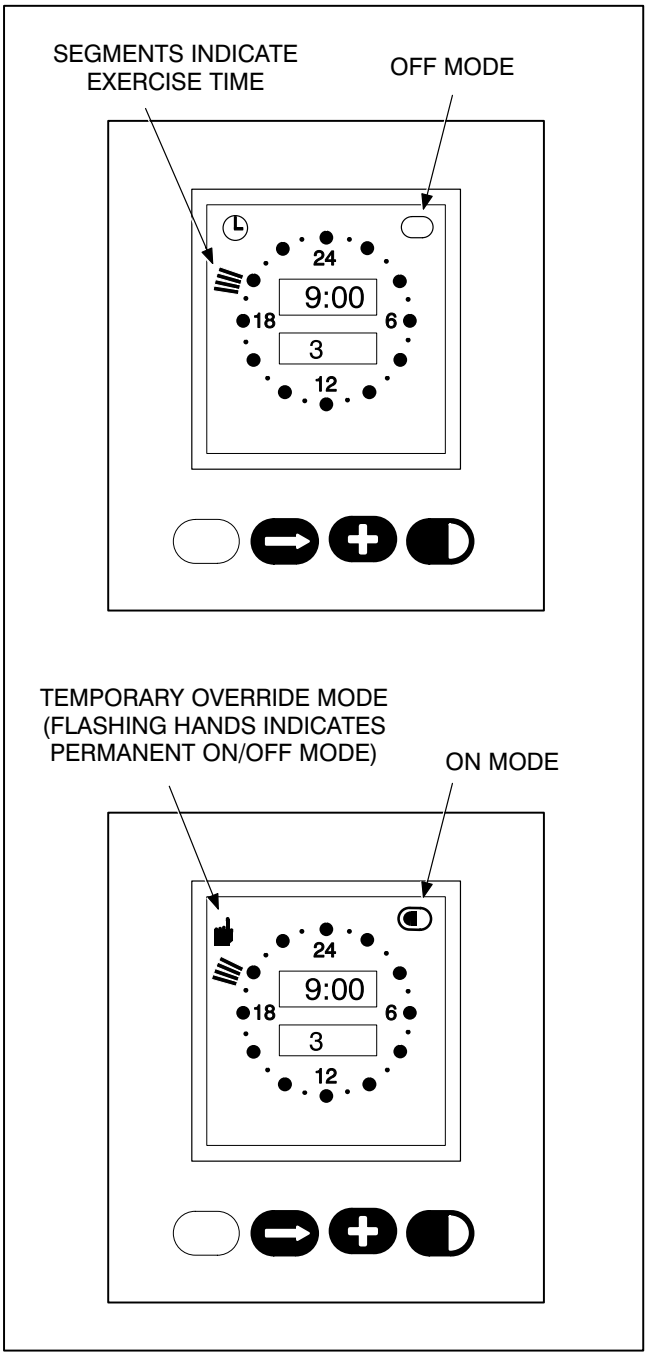


FIGURE 3-7. EXERCISER CLOCK ON/OFF MODE

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To check the programs:

Push the arrow (→) button to review each setting.

To erase (clear) a program:

Press the arrow (→) button until the program mode (Pr) is reached. Press the arrow (→) button again to select the desired day. To clear the program for the day selected, press the plus and set (**+**) (◗) buttons at the same time.

To Initiate or Override an Exercise Program:

The exerciser clock has a built-in test feature. Once the clock time has been set, the set button (◗) can be used to initiate a test or to cancel a test in progress.

With the normal source connected and available, pressing the set (◗) button once initiates a test sequence. A hand is displayed in the upper left corner of the display and the ON mode is indicated inside the ellipse in upper right corner of the display (Figure 3-7). Pressing the set (◗) button again stops the test and the ellipse indicates the OFF mode.

To temporarily override an activated exercise program, *momentarily* press the set (◗) button. A small hand will appear in the upper left corner of the display (Figure 3-7). The current program is overridden and the clock automatically sest the next program. Momentarily pressing the set (◗) button again returns to the current program.

Permanent On/Off Mode:

Holding the set (◗) button down until a *flashing hand appears* in the upper left corner of the display initiates the permanent On/Off mode. The ON mode is indicated by a continuous band of segments illuminated around the clock. The OFF mode is indicated by all of the segments around the clock being off. Pressing the set (◗) button momentarily toggles between the permanent On and permanent Off modes. Holding the set (◗) button down until the clock symbol returns to the upper left corner of the display, ends the continuous On/Off mode and returns to the normal program mode.

Test With Load or Without Load

The exerciser clock has a built-in test button. Once the clock time has been set, the set button (◗) can be used as a test button.

The Load/No-Load switch, on the control circuit board (Figure 2-5) can be set to test the genset with or without load, as desired.

With the normal source connected and available, pressing the set (◗) button once will initiate a test sequence. A hand will be displayed in the upper left corner of the display and the On mode will be indicated inside the ellipse in upper right corner of the display (Figure 3-7). Pressing the set (◗) button again will stop the test and the ellipse will indicate the OFF mode.

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4. Troubleshooting

INTRODUCTION

This section describes the theory of the control system operation and provides a troubleshooting guide to help diagnose transfer panel problems.

CONTROL SYSTEM OPERATION

The following text covers the operation of the electronic control system. The following situations and control responses are described:

- Normal Power Source Connected to Load
- Normal Power Source Interrupted
- Emergency Power Source Connected to Load
- Normal Power Source Restored
- Test/Exercise With/Without Load

Some control commands can be verified by observing the indicator LEDs on the control board (Figure 4-1). The control schematic (Section 6) and the schematic and wiring diagram package shipped with the unit will help you follow the operation descriptions.

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform.***

Indicator LEDs

Eight indicator LEDs are mounted on the upper right side of the control circuit board. Remove the circuit board cover to observe the indicator LEDs. Table 4-4 describes each of the LEDs.

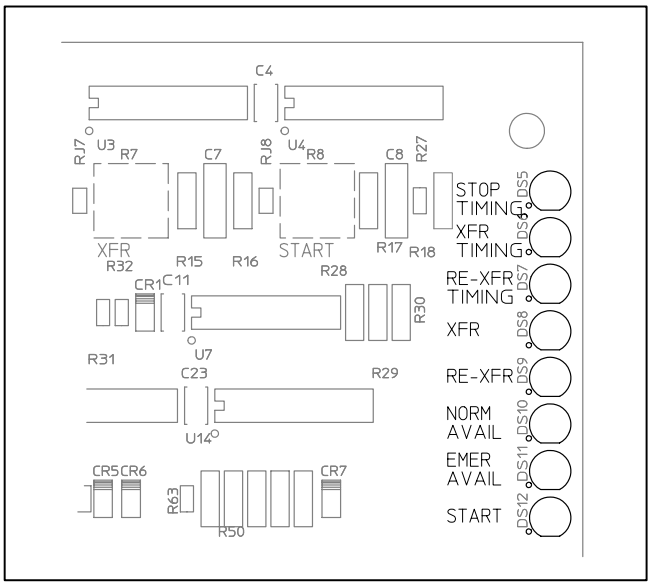


FIGURE 4-1. CONTROL BOARD LEDS

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TABLE 4-4. CONTROL CIRCUIT BOARD INDICATOR LAMPS

LED	INDICATES
Stop Timing DS5	The control is timing out the generator stop delay. at the end of this delay, a stop signal is sent to the generator set and the Start (Gen Set) and Stop Timing LEDs go out.
Transfer Timing DS6	Control is timing out for transfer to Emergency power. At the end of the timing period, the LED goes out and the Transfer (Active) LED turns on.
Retransfer Timing DS7	Control is timing out for retransfer to Normal power. At the end of the timing period, the LED goes out and the Retransfer (Active) LED turns on.
Transfer (Active) DS8	Control is signaling for transfer to Emergency power. The Emergency Available LED is also on.
Retransfer (Active) DS9	Control is signaling for retransfer to Normal power. The Normal Available LED is also on.
Normal Available DS10	Normal voltage is available and within the voltage settings of the voltage sensor.
Emergency Available DS11	Emergency voltage is available and within the voltage settings of the voltage sensor.
Start (Gen Set) DS12	The control is signaling the generator set to run. This LED is dimly lit (or off) when both sources are off.

Normal Power Source Connected to Load

The Normal Available LED is on to indicate that the normal power source is within the voltage settings of the voltage sensor. The Retransfer Active LED is on to indicate that the control is signaling for the load to be connected to the normal power source (retransfer). No other indicator LEDs are on.

The normally energized genset start relay (A1-K3) and the retransfer relay (A1-K1) are energized and contactor coil K1 is energized connecting the Load to the Normal power source. The K1 auxiliary contacts are actuated, the contacts change position from their normal state.

Normal Power Source Interrupted

An interruption in power can be defined as not only the complete loss of power but also as any situation where the voltage is outside the settings of the voltage sensor. The voltage sensor responds to all power interruptions by blocking the Normal Available signal.

Normal Voltage Sensor: The undervoltage sensor begins timing if the source fails or if the voltage falls below the dropout setting. The undervoltage dropout time delay is factory set for 0.8 seconds and is not adjustable. Unless power is lost completely, both the Normal Available LED and the Retransfer Active LED remain on during the undervoltage dropout time delay. If the voltage returns during the 0.8 second delay, the sensor resets itself. This short delay prevents the time delay module from responding during momentary dips in voltage.

Start Time Delay: If the Normal power source is still faulty after the voltage sensor has timed out, all indicator lamps go out and the start time delay begins timing. The start time delay is 3 seconds on control package A and is adjustable from 0.5 to 15 seconds on control package B. All lamps stay out while the start time delay is timing. The start time delay prevents generator set startup when a power interruption of very short duration occurs. If the Normal power source returns during the timing period, the start time delay is reset.

Capacitor C29 on the electronic control board provides power to the electronic control and time delay during this timing period. A start signal is produced when the time delay expires.

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After the start time delay has timed out, a signal from the time delay de-energizes the normally energized two-wire start relay (A1-K3), lights the Start Gen Set LED (dimly), and (if applicable) sends a start signal to the 3-Wire Start module.

On two-wire start systems, A1-K3 contacts close and signal the generator set to run. On three-wire start systems, a relay in the 3-Wire Start module signals the generator set to run. The Start Gen Set LED remains lit as long as the control is signaling the generator set to run.

Emergency Voltage Sensor: The Emergency voltage sensor monitors the voltage output from the generator set. When the voltage rises above the pickup setting, the sensor signals that the Emergency power source is available. The Emergency Available LED lights and stays on as long as the Emergency power source is within the voltage settings of the voltage sensor.

Transfer Time Delay: The transfer time delay begins timing as soon as the voltage sensor signals that Emergency voltage is available. The transfer time delay is fixed at 3 seconds for control package A and is adjustable from 2 to 120 seconds on control package B. The Transfer Timing lamp lights to indicate that the transfer time delay is timing. This pause before transferring the load to the generator is to allow the generator set to stabilize.

Transfer of Load: After the transfer time delay has timed out, the transfer signal energizes the transfer control relay A1-K2.

When A1-K2 is energized, its normally open contacts close and energize the K1 relay trip coil, if applicable. When K1 relay de-energizes, the K1 auxiliary contacts change back to their normal state.

Relay K2 closing coil is energized, when K2 closing coil is energized, K2 contacts close and connect the Load to the Emergency power source.

Emergency Power Source Connected to Load

When the Emergency Available LED is lit, this indicates that the Emergency power source is within the voltage settings of the voltage sensor. The Transfer Active LED is on to indicate that the control is signaling for the load to be connected to Emergency power source. The Start Gen Set LED is on to indicate that the control is signaling for the generator set to run.

Normal Power Source Returns

The time delay circuit is programmed to identify the Normal power source as the preferred power source. The return of Normal power initiates several control responses that eventually cause the load to retransfer to the Normal side (assuming that the Auto/Manual switch A1-S3, is in the Auto position).

Normal Voltage Sensor: The Normal voltage sensor monitors the Normal power source. When the voltage satisfies the pickup setting requirements, the sensor signals that Normal voltage is available. The Normal Available LED lights and stays on as long as the Normal source voltage is within the voltage settings of the voltage sensor.

Retransfer Time Delay: The retransfer time delay begins timing as soon as the voltage sensor signals that Normal voltage is available. The retransfer time delay is 5 minutes with control package A and is adjustable from 6 seconds to 30 minutes with control package B. The Retransfer Timing lamp lights while the retransfer time delay is timing. This delay allows the line voltage to stabilize before retransferring to the Normal power source.

Retransfer of Load: After the retransfer time delay has timed out, the time delay generates a retransfer signal. The retransfer signal energizes the retransfer control relay A1-K1.

When retransfer relay A1-K1 is energized, its normally open contacts close, and energize the K2 trip coil, if applicable. When the K2 relay de-energizes the K2 auxiliary contacts change back to their normal state.

Relay K1 contactor coil is energized connecting the Load to the Normal power source.

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Stop Time Delay: The stop time delay begins timing as soon as the Retransfer Complete LED lights. The stop time delay is 5 minutes with control package A and is adjustable from 2 seconds to 10 minutes with control package B. The Stop Timing LED lights while the stop time delay is timing. This delay allows the generator set to cool down while running at no load. When the stop time delay has timed out (provided that A1-K3 is de-energized), the time delay energizes the two-wire start relay (A1-K3), turns off the Start Gen Set LED, and (if applicable) sends a stop signal to the 3-Wire Start module.

On two-wire start systems, A1-K3 contacts open, removing the generator set run signal. On three-wire start systems, a relay in the 3-Wire Start module signals the generator set to stop. After the generator set stops, the Emergency Available LED goes out.

Test/Exercise With/Without Load

To follow this description of of generator set test and exercise functions, refer to the control schematic in Section 6.

Signal to Test/Exercise: The signals to initiate a test or exercise enter the electronic control circuit board at:

- Remote Test input J7 and J8
- Optional Exerciser Clock Program − Exerciser Clock output.

The signal consists of a switch closing to ground or the exerciser clock output going low.

Starting the Generator Set: When an exercise signal is received, the normally energized two-wire start relay is de-energized and a start signal (if applicable) is sent to the 3-Wire Start module.

Generator Set Starts: As the generator set runs and produces power (at an acceptable voltage), the Emergency Available LED lights.

With/Without Load: If switch A1-S2 is in the No Load position, the control senses that both sources are available. The control is configured to prefer Normal. No transfer of load occurs.

If A1-S2 is in the Load position, a power failure (although simulated) is sensed and transfer of load timing begins. After the transfer delay, the control signals for a transfer of load.

End of Test/Exercise: The test/exercise period is stopped by removing the ground from J4-5, or when the exerciser clock exercise period elapses.

If the test/exercise was conducted without load, the two-wire start signal is removed (A1-K3 is energized) and (if applicable) a stop signal is sent to the 3-Wire Start module.

If the test/exercise was conducted with load, the Normal voltage sensor will sense Normal power and begin retransfer timing.

After the retransfer delay has timed out, retransfer to the Normal power source occurs. After retransfer, and after the stop time delay, the control sends out a stop signal. This signal terminates both two-wire and three-wire start signals.

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TROUBLESHOOTING

Use the following troubleshooting guide to help diagnose transfer panel problems. The troubleshooting guide is divided into sections based on the symptom. Common problems are listed with their possible causes. Refer to the corrective action column for the appropriate test or adjustment procedure. The section and page number in the right column lists the location of the test or adjustment procedure in this manual.

Conditional schematics are used to highlight the circuitry that is energized during the sequence of events. These conditional schematics are for a typical transfer panel with options. Always refer to the (five sheet) schematic and wiring diagram package that was shipped with the transfer panel for specific information about its configuration.

Make a thorough inspection of the transfer panel wiring to make sure that good wire harness and ground connections are made. Correct wiring problems before performing any tests or replacing any components.

Troubleshooting Warnings

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform.***

Remove power to the door by disconnecting connector J1/P1 before removing and replacing components. The following procedures are to be performed by trained and experienced personnel only.

⚠WARNING ***Improper operation of the generator set presents multiple hazards that can cause severe personal injury or death. Observe all of the safety precautions in your generator set manuals.***

Description of Problem **Page**

Power Outage Occurs, But Generator Set Does Not Start 4-7
Generator Starts But Does Not Assume Load 4-9
Transfer Panel Does Not Retransfer When Normal Voltage Returns
− or − On Initial Installation 4-11
Generator Set Continues To Run After Retransfer of Load To Normal Source 4-13
Generator Set Starts During Normal Power Service 4-14
Generator Set Does Not Exercise/Exercises But Does Not Transfer Load 4-15
Battery Charger Malfunction 4-16

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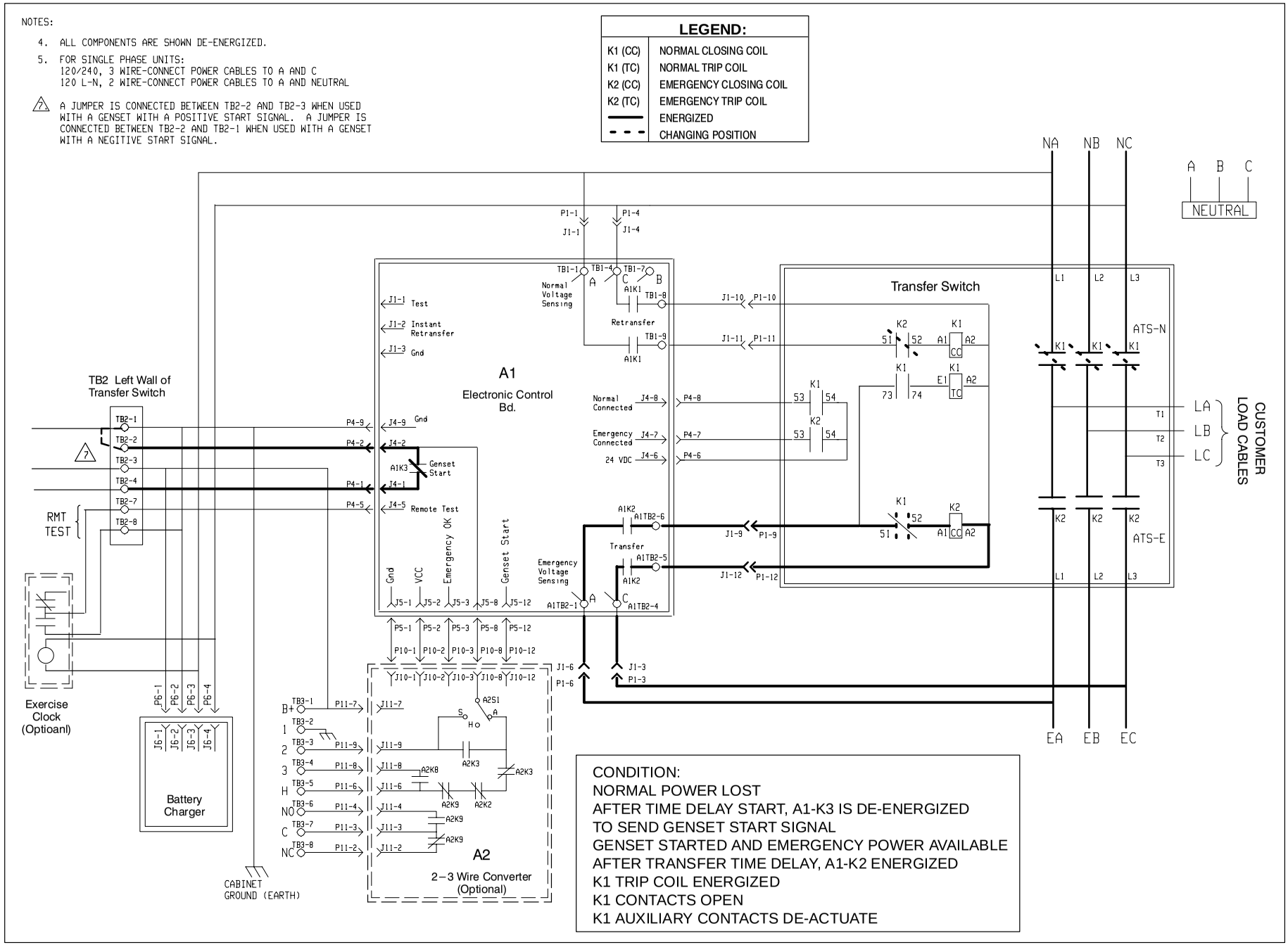


FIGURE 4-2. TYPICAL CONDITIONAL SCHEMATIC − NORMAL POWER OUTAGE OCCURS

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⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. The following procedures are to be performed only by technically qualified personnel. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components.***

⚠WARNING ***Improper operation of the generator set presents multiple hazards that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.***

TABLE 4-5. POWER OUTAGE OCCURS, BUT GENERATOR SET DOES NOT START

Problem	Possible Cause	Corrective Action	Section/ Page
Genset Does Not Start When Normal Power Is Lost *DS12 OFF*	1. 3-Wire Start: Selector switch S2 not in Auto position.	1. Set selector switch to Auto.	3-4
	2. 3-Wire Start: Overcrank condition.	2. Check for overcrank condition. Reset. If genset does not crank, check connections to 3-wire start module including ribbon cable to electronic control assembly and check 3-wire start module.	
	3. 2-Wire Start: Selector switch on genset control not in Remote.	3. Set selector switch on genset to Auto	
	4. Genset cranks but does not start. Genset problem.	4. Check fuel system. Refer to genset service manual.	
	5. Genset does not crank.	5a. Start genset at genset control. If it starts, check wiring of TB2 per the wiring diagram (Section 6). Check the wiring between the transfer panel and the genset. If OK, go to step seven. 5b. If it does not crank, check batteries and cable connections (also refer to Table 4-7). 5c. If it cranks but does not start at genset control, check fuel system and refer to genset service manual.	
	6. No genset start signal from transfer panel.	6. Check for start signal between J4-1 and J4-2. Zero VDC should be measured. Check P4-1, P4-2 connections, If good, the electronic control board A1 is defective.	5-6
DS12 ON	1. Defective electronic control board A1.	1. Replace electronic control board A1.	5-6

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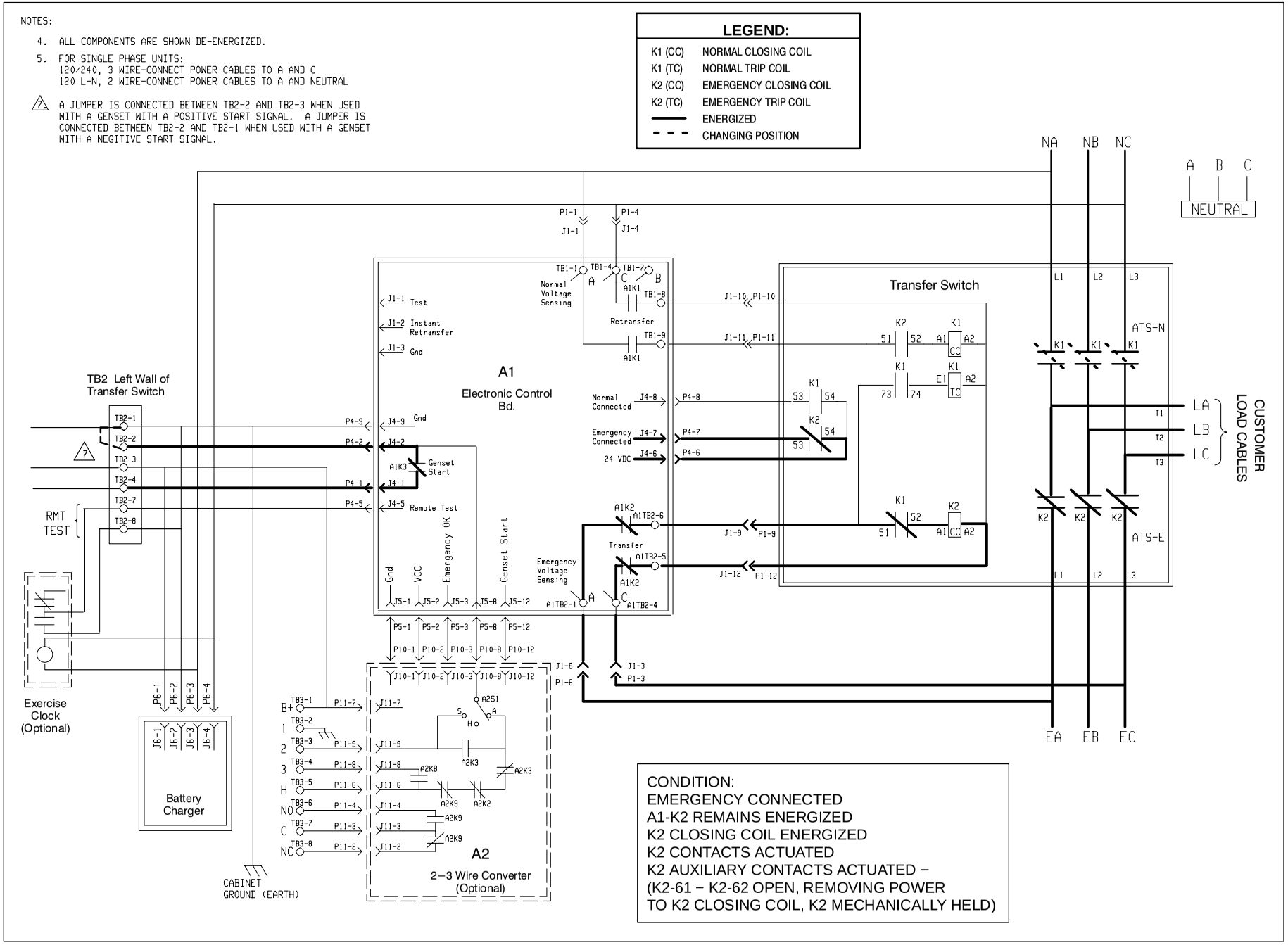


FIGURE 4-3 . TYPICAL CONDITIONAL SCHEMATIC – EMERGENCY CONNECTED

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⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. The following procedures are to be performed only by technically qualified personnel. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components.***

⚠WARNING ***Improper operation of the generator set presents multiple hazards that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.***

TABLE 4-6. GENERATOR SET STARTS BUT DOES NOT ASSUME LOAD

Problem	Possible Cause	Corrective Action	Section/ Page
Genset Starts But Does Not Assume Load *DS11 OFF*	1. Generator voltage not available at A and B power poles of transfer switch.	1a. Test relay A1-K2, replace relay if faulty. 1b. Defective electronic control board (A1).	5-6 5-6
	2. Generator voltage available at A and B power pole but emergency side of switch does not close.	2a. If normal side is still held, check voltage on trip coil (K1-TC). If voltage is present, replace the trip coil. 2b. Check for voltage on the emergency side closing coil (K2-CC). If voltage is present, replace the trip coil.	5-3/ 5-6 5-3/ 5-6
	3. Emergency side closes but K2 contacts are defective.	3. Replace K2 contactor.	5-3/ 5-6
DS11 OFF	1. Low voltage from genset.	1. Check output voltage from genset. This could be a genset problem.	
	2. Bad connection at connector P1.	2. Check continuity through connector P1.	

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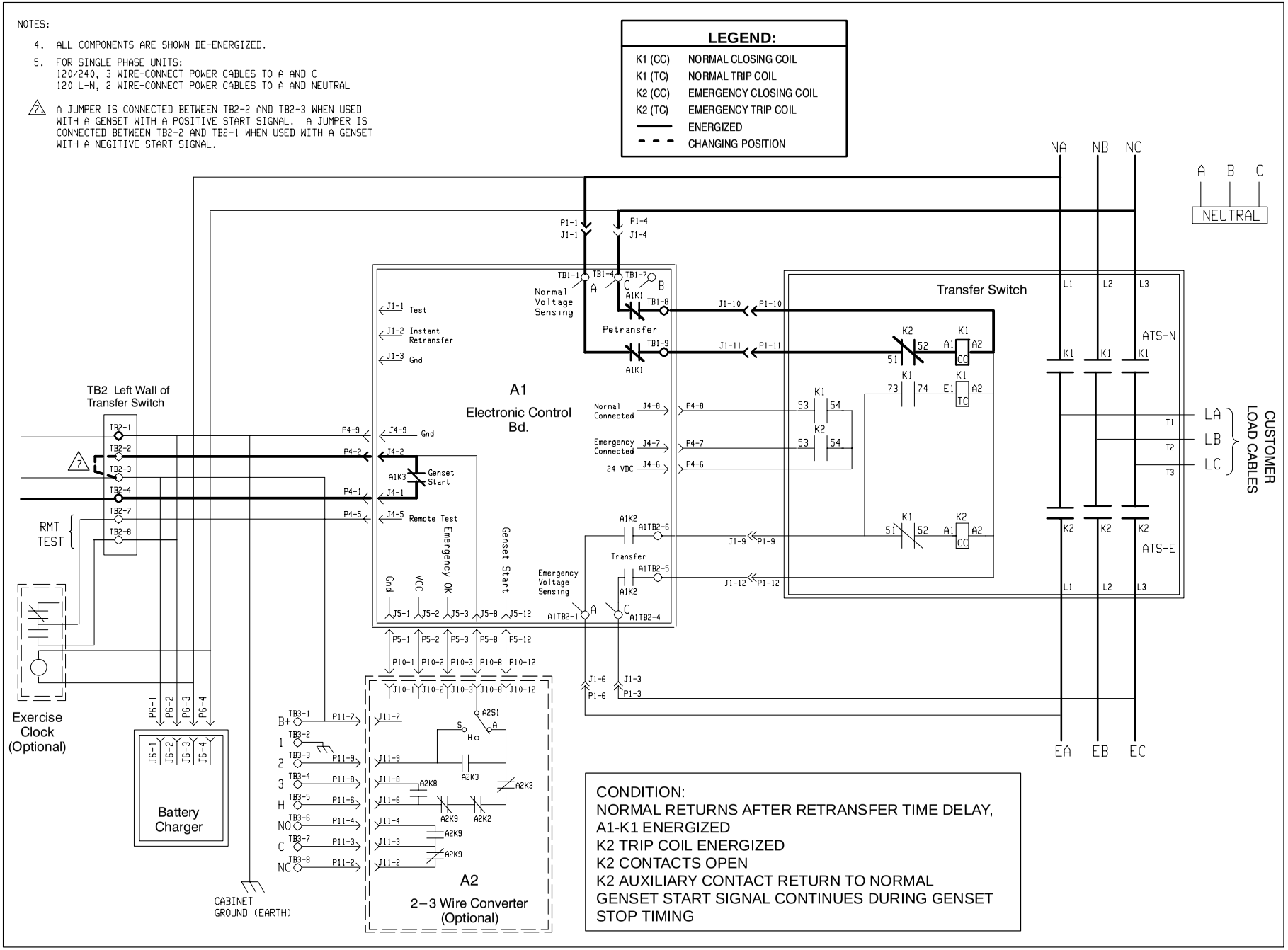


FIGURE 4-4. TYPICAL CONDITIONAL SCHEMATIC − NORMAL RETURNS

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⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. The following procedures are to be performed only by technically qualified personnel. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components.***

⚠WARNING ***Improper operation of the generator set presents multiple hazards that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.***

TABLE 4-7. TRANSFER PANEL DOES NOT RETRANSFER WHEN NORMAL VOLTAGE RETURNS AFTER A POWER OUTAGE OR ON INITIAL INSTALLATION

Problem	Possible Cause	Corrective Action	Section/ Page
Does Not Retransfer After Re-transfer Time Delay	1. Line voltage available at NA and NC power poles.	1a. Test relay A1-K1. If the relay is faulty and is not soldered in, replace it. If the relay is faulty but is soldered in, replace the board. 1b. The Retransfer Time Delay program is not complete.	5-6
DS10 ON	2.	1c. If emergency side is still held, check K1 and K2 auxiliary contacts and emergency side trip coil (K2-TC), if equipped. 1d. Check normal side closing coil (K1-CC). Replace coil is voltage is present.	5-3/ 5-6 5-3/ 5-6
	3. Normal side closes but K1 contactors are defective.	3. Replace K1 contactors.	5-3/ 5-6
	4. Defective electronic control board (A1).	4. Replace the electronic control board A1.	5-6
DS10 OFF	1. Normal side line voltage inadequate.	1. Measure normal side voltage.	
	2. Bad connection at connector P1.	2. Check continuity through connector P1.	
	3. Normal side voltage sensor out of calibration.	3. Calibrate normal side undervoltage sensor.	3-2
	4. Optional clock is on override or defective.	5. Cancel test on clock or clock is shorted.	3-6
	5. Defective electronic control board (A1).	7. Replace the electronic control board A1.	5-6

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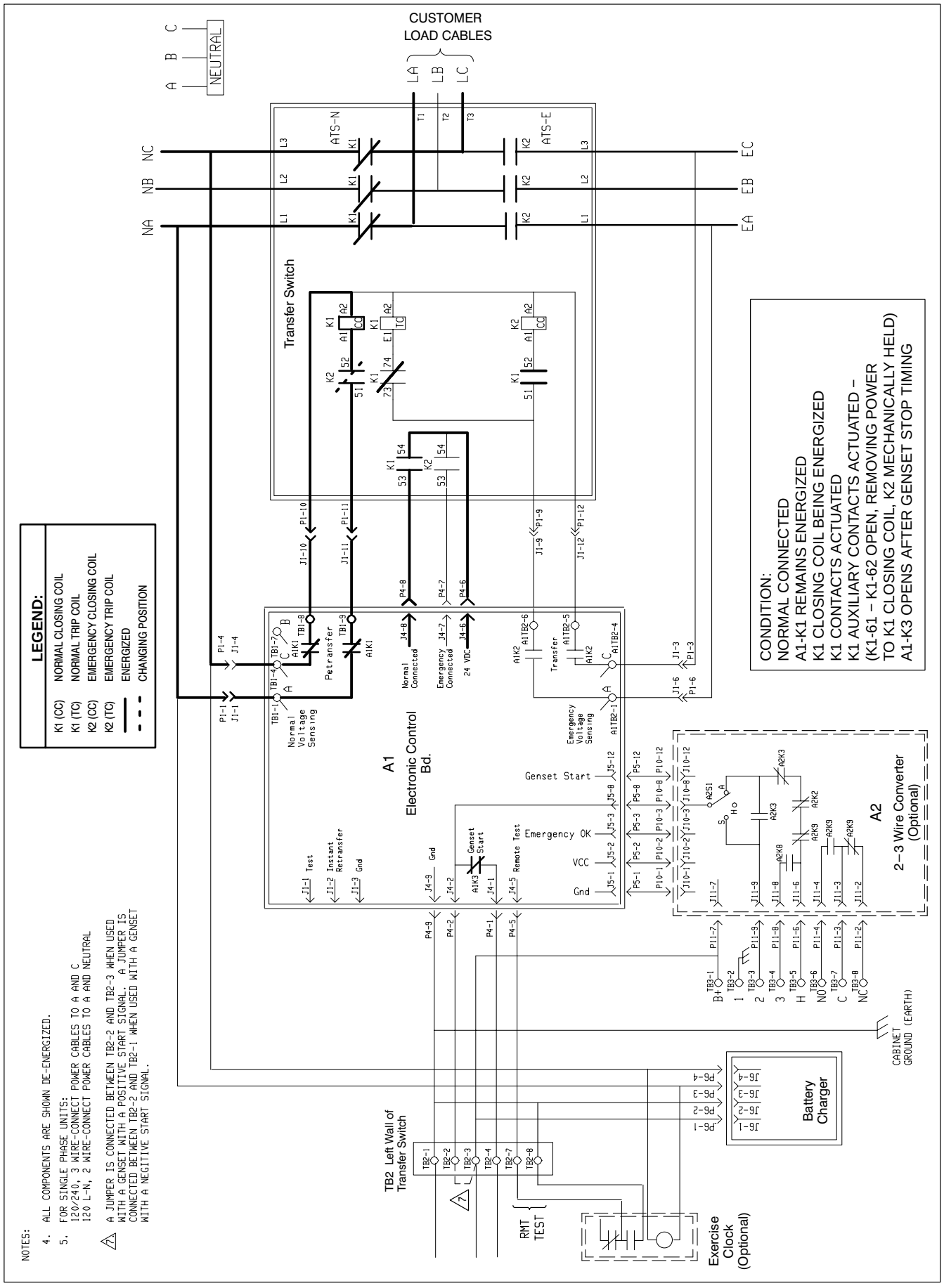


FIGURE 4-5. CONDITIONAL SCHEMATIC – NORMAL CONNECTED

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⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. The following procedures are to be performed only by technically qualified personnel. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components.***

⚠WARNING ***Improper operation of the generator set presents multiple hazards that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.***

TABLE 4-8. GENERATOR SET CONTINUES TO RUN AFTER RETRANSFER OF LOAD TO NORMAL SOURCE

Problem	Possible Cause	Corrective Action	Section/ Page
Genset Continues To Run After Retransfer	1. Exercise program set on exerciser clock (optional).	1. Check exerciser clock settings.	3-5
	2 Retransfer time delay still timing.	2a. Check setting, if time exceeds maximum setting, electronic control board (A1) is defective. 2b. Problem with genset control	3-3

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⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. The following procedures are to be performed only by technically qualified personnel. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components.***

⚠WARNING ***Improper operation of the generator set presents multiple hazards that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.***

TABLE 4-9. GENERATOR SET STARTS DURING NORMAL POWER SERVICE

Problem	Possible Cause	Corrective Action	Section/ Page
Genset Starts During Normal Power Service	1. 2-Wire Start: Selector switch on genset not set on Remote.	1. Set selector switch to Remote.	–
	2. 3-Wire Start: Selector switch on 3-wire start module not set on Auto.	2. Set selector switch on 3-wire start module on Auto.	3-4
	3. Low line voltage	3. Normal power source is out of specification.	
	4. Exercise period set on exerciser clock (Optional)	4. Refer to exerciser clock programming instructions.	3-5
	5. Remote test customer input.	5. Check for remote test input at J4-5.	

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⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. The following procedures are to be performed only by technically qualified personnel. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components.***

⚠WARNING ***Improper operation of the generator set presents multiple hazards that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.***

TABLE 4-10. GENERATOR SET DOES NOT EXERCISE OR EXERCISES BUT DOES NOT TRANSFER LOAD

Problem	Possible Cause	Corrective Action	Section/ Page
Genset Does Not Exercise	1. 2-Wire Start: Selector switch on genset not set on Remote.	1. Set selector switch to Remote.	–
	2. 3-Wire Start: Selector switch on 3-wire start module not set on Auto.	2. Set selector switch on 3-wire start module on Auto.	3-4
	3. Exercise period not programmed on exerciser clock (Optional).	3. Refer to exerciser clock programming instructions.	3-5
	4. Genset cranks but does not start.	4. Genset fuel system or other genset problem, refer to genset service manual.	
	5. No start signal from transfer panel when exercise clock is in program mode or remote start signal present.	5a. Check for start signal between TB2-1 and TB2-3. Zero VDC should be measured. Check P4-1, P4-2 connections, If good, the electronic control board A1 is defective. 5b. Check wiring between the genset and the switch.	
	6. Genset does not crank.	6. Refer to troubleshooting Table 4-5.	4-7

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⚠WARNING AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. The following procedures are to be performed only by technically qualified personnel. Use extreme caution to avoid touching electrical contacts when the cabinet door is open. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform. Remove power to the door by disconnecting connector J1/P1 (on the accessory control panel) before removing and replacing components.

⚠WARNING Improper operation of the generator set presents multiple hazards that can cause severe personal injury or death. Observe all safety precautions in your generator set manuals.

TABLE 4-11. BATTERY CHARGER MALFUNCTIONS

Problem	Possible Cause	Corrective Action	Section/ Page
Battery Charger Fails To Charge	1. No DC output.	1a. Check battery charger fuse(s). 1b. Check input voltage to battery charger, make sure input voltage is adequate and that it is the correct charger for the available voltage. 1c. Defective battery charger.	3-7
	2. Float voltage set too low.	2. Increase float level adjustment.	3-8
Battery Charger Under-charges	1. Defective battery.	1. Check for defective battery.	
	2. Battery charger float level set too low.	2. Increase float level adjustment. Periodically check specific gravity to obtain the proper charge rate.	3-8
Battery Charger Over-charges	1. Battery charger float level set too high.	1a. Check battery for signs of electrolyte bubbling. Add electrolyte if needed. 1b. Decrease float level adjustment. Periodically check specific gravity to obtain the proper charge rate. 1c. Recheck calibration.	3-8 3-1

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5. Transfer Panel Service

INTRODUCTION

This section covers the service procedures for the components of the contactor assembly. There are two types of contactor assemblies. Each type corresponds to an ampere range. The two ampere range groups are: 60-amperes and 100- through 200-amperes. Removal and service procedures for each amperage range group are described separately.

The contactor assemblies make and break the current flow. When closed to the Normal power source the contactors are magnetically held. The Emergency side is electronically held. A mechanical interlock prevents them from closing to both power sources at the same time.

Refer to Figure 2-3 for transfer panel component locations.

DISCONNECT AC POWER

Before beginning any service procedure:

1. If the generator set provides Emergency power, turn the operation selector switch to OFF. (The selector switch is located on the generator set control panel.)

 Disconnect all sources of AC power from the transfer panel.

2. Disconnect the battery charger from the AC power source. Then disconnect the genset starting battery (negative [−] lead first).

 ⚠WARNING ***The transfer panel presents a shock hazard that can cause severe personal injury or death unless all AC power is removed. Disconnect all sources of AC power from the transfer switch before servicing. Be sure to move the generator set operation selector switch to Stop, disconnect the battery charger from its AC power source, and disconnect the starting battery (negative [−] lead first).***

RECONNECT AC POWER (WHEN FINISHED)

After all service procedures are completed:

- If the generator is the Emergency power source, connect the negative (−) battery cable to the starting battery. Connect the battery charger to its AC power source.
- Reconnect the Normal power source and Emergency power source.
- Place the operation selector switch in the Remote position.

 ⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts whenever the cabinet door is open. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform.***

60-AMPERE CONTACTOR ASSEMBLY SERVICE

The following procedures cover service procedures for the 60-ampere contactor assembly. Figure 5-1 shows a typical 60-ampere contactor assembly.

Follow the procedure on left to disconnect the transfer panel from the AC power source.

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer panel before servicing.***

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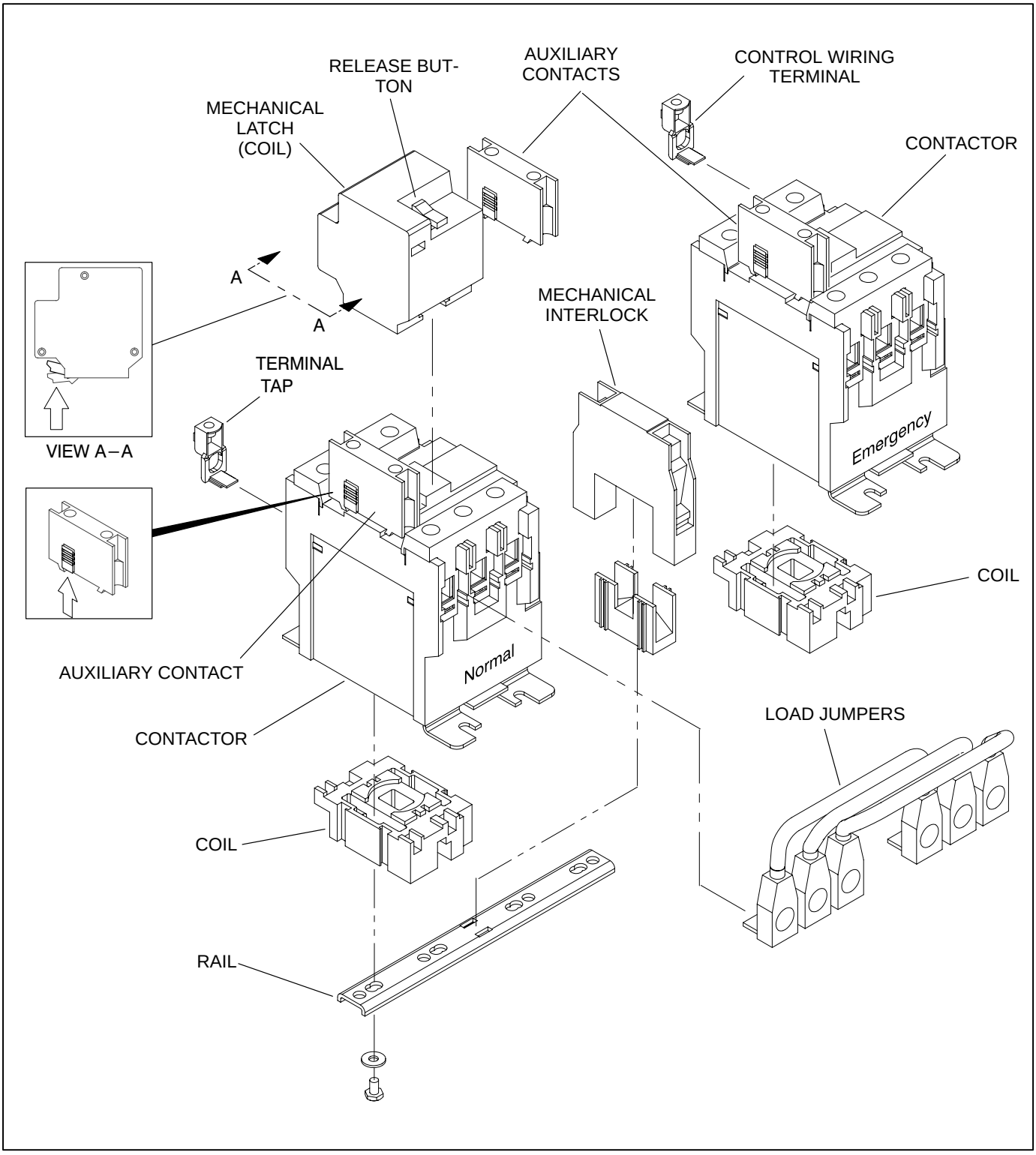


FIGURE 5-1. 60-AMPERE CONTACTOR ASSEMBLY (TRANSFER SWITCH)

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Auxiliary Contacts

The auxiliary contacts are secured by a mechanical latch to the Normal and Emergency side of the contactor assembly as shown in Figure 5-1. When an auxilliary contact fails, the switch will not function.

If an ohmmeter check indicates a faulty contact, remove the auxiliary contact by sliding the locking tab up and sliding the auxiliary contact off the contactor.

Slide the new auxiliary contact into the track on the contactor until a click is heard indicating that the latch is engaged. Transfer the leads from the old auxiliary contact to the new one.

Mechanical Latch Service

The mechanical latch contains a set of contacts and a trip coil on the Normal side of the contactor. Its basic function is to release a mechanically held contactor.

To release the contactor, push the orange release button on top of the latch forward.

If an ohmmeter check indicates a faulty contact, or if the trip coil does not function when the appropriate voltage (indicated on top of the mechanical latch) is applied, replace the defective mechanical latch. Remove the mechanical latch by lifting the locking tab on the mechanical latch (Figure 5-1). Slide the mechanical latch out from the contactor.

NOTE: The trip coil cannot be checked with an ohmmeter due to a rectifier circuit contained inside the sealed coil assembly.

Install the mechanical latch by sliding it onto the contactor assembly. The mechanical latch should lock in place. Transfer the leads from the old mechanical latch to the new one.

Mechanical Interlock Service

The mechanical interlock prevents the Normal and Emergency power sources from closing at the same time. The interlock contains two sets of normally closed contacts and the mechanism that provides the mechanical interlock.

If an ohmmeter check indicates a faulty contact, or if the mechanical interlock does not function properly, replace the mechanical interlock. Remove the transfer switch from the cabinet. Then remove the bottom rail to access the mechanical interlock. When reinstalling, align the pin on the side of the mechanical interlock with the hole in the contactors.

Contactor Assembly Service

The contactor assembly has no adjustable components. The main contacts in the 60-ampere contactor assemblies are not serviceable except for the coil and terminal taps. If the contactors are defective, replace the contactor assembly.

Contactor Coil: If the contactor coil is suspect, it can be checked with an ohmmeter. Remove the harness leads from the coil. The 60-ampere coils are rated at 240 VAC, 50/60 Hz. The resistance in the 240 volt windings are 131 ohms, ±10%. The resistance in 120 volt windings are 28 ohms, ±10%. Replace the coil if defective.

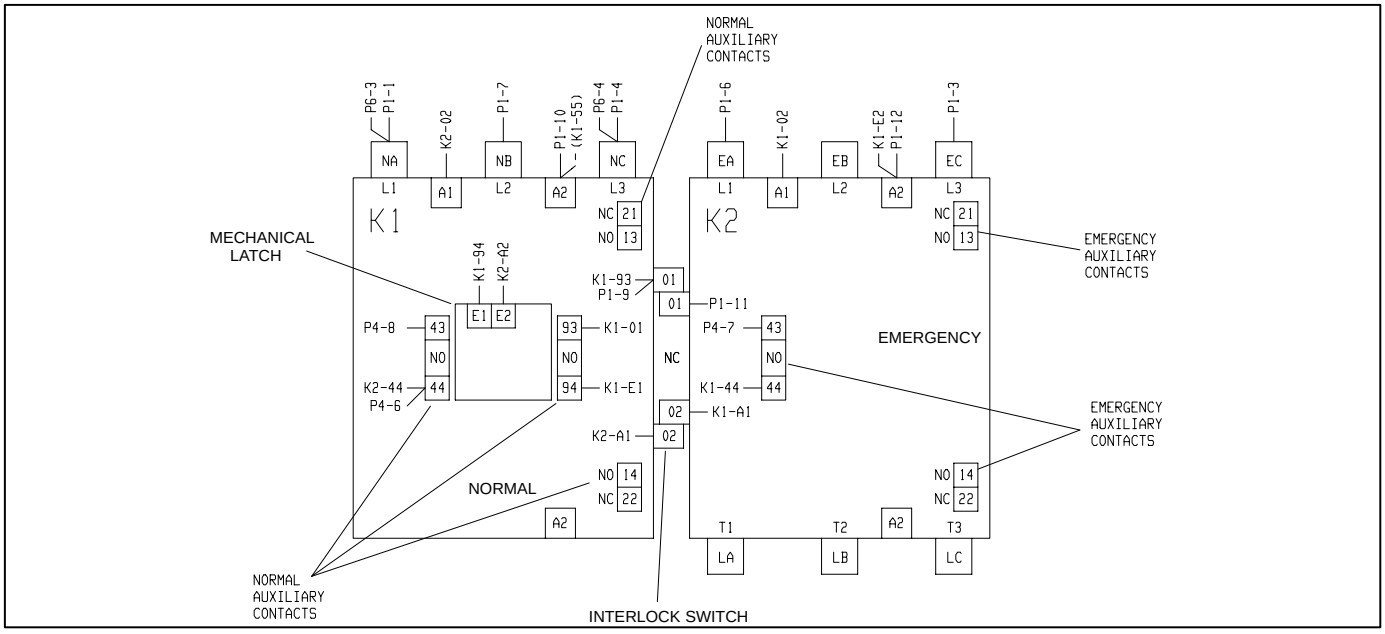


FIGURE 5-2. 60-AMPERE TRANSFER SWITCH WIRING DIAGRAM

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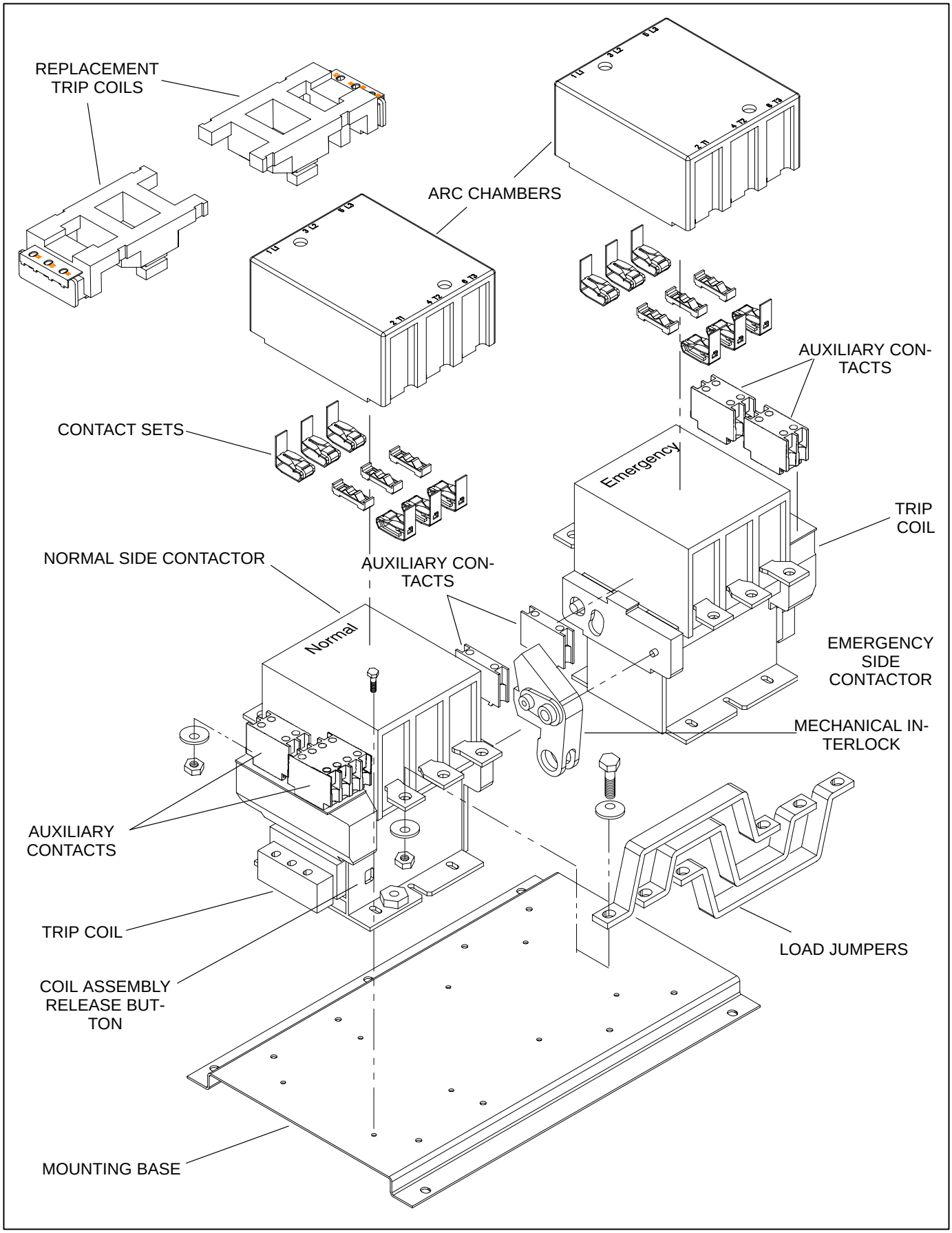


FIGURE 5-3. 100 AND 200-AMPERE CONTACTOR ASSEMBLY (TRANSFER SWITCH)

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100 AND 200-AMPERE CONTACTOR ASSEMBLY SERVICE

Prior to opening the panel door, follow the procedure on page 5-1 to disconnect the transfer panel from the AC power source.

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer panel before servicing.***

The following procedures cover the service procedures for the 100- and 200-ampere contactor assembly. Figure 5-2 shows a typical 100- and 200-ampere contactor assembly.

Auxiliary Contact Service

Auxiliary contacts are attached to the Normal and Emergency sides of the contactor assembly as shown in Figure 5-3. The auxiliary contacts are secured to the contactor assembly by a mechanical latch.

If an ohmmeter check indicates a faulty contact, replace the defective auxiliary contact. Remove the auxiliary contact by lifting the locking tab on the auxiliary contact assembly shown in Figure 5-4 and slide the auxiliary contact out.

Slide the new auxiliary contact into the track of the contactor until a click is heard indicating that the latch is engaged. The auxiliary contact should lock in place. Transfer the leads from the old auxiliary contact to the new one.

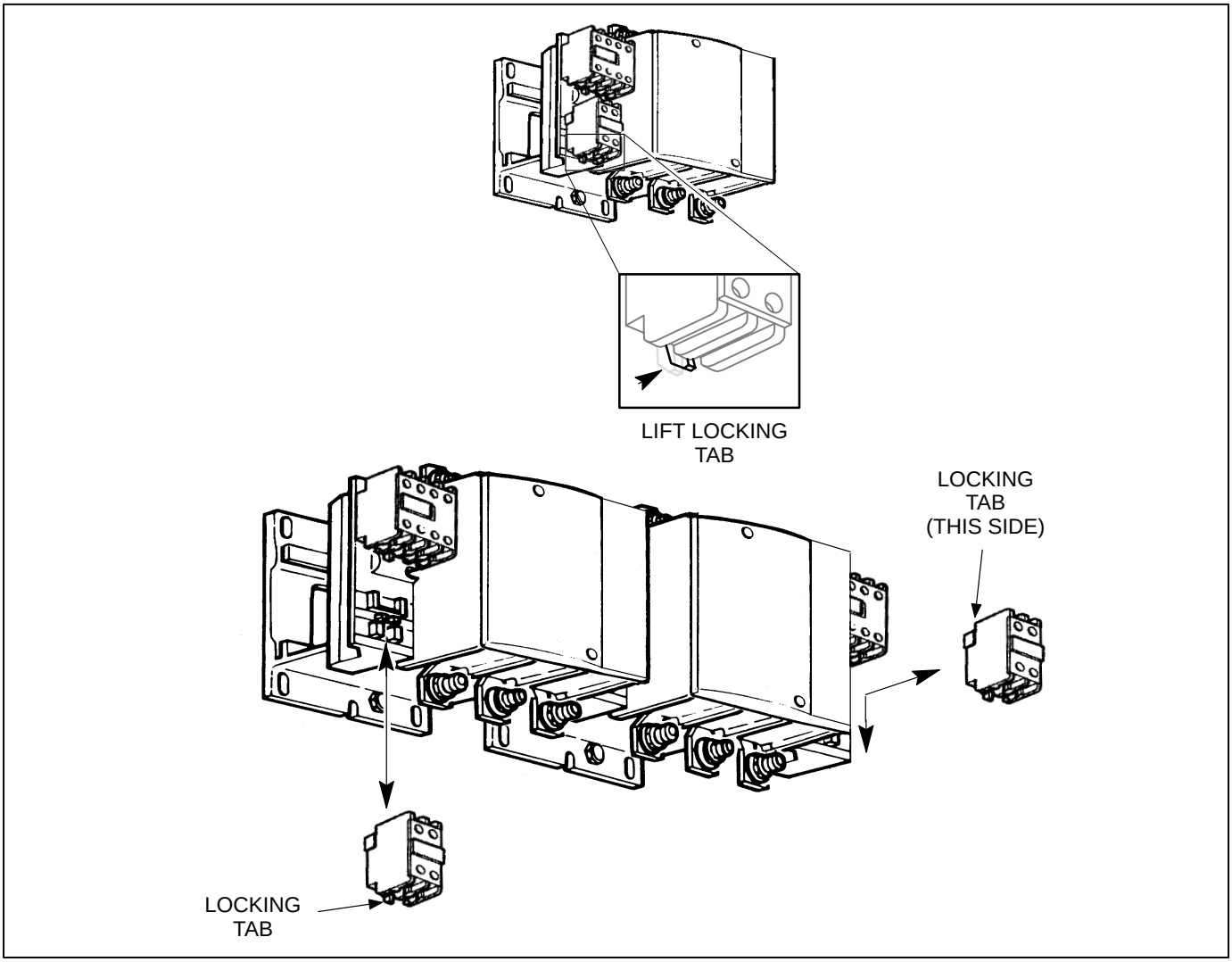


FIGURE 5-4. AUXILIARY CONTACT ASSEMBLY REMOVAL/INSTALLATION

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Contactor Assembly Service

The contactor assembly has no adjustable components. It is normal for the arc chamber and the main contacts to darken with use. The main contacts, arc chamber and the closing and trip coil are replaceable.

Arc Chamber: The arc chambers are secured with quarter-turn fasteners. To remove the arc chambers, push down on the fasteners with a screwdriver and rotate 90° in either direction. To reinstall, again push down on the fasteners and rotate 90° in either direction. Release the fastener and check for a secure fit.

Main Contact Set: The main contacts are replaceable, do not file, lubricate or attempt to repair the main contact set. The upper contacts are removed by depressing the retainer on top the contacts and rotating the retainer and contact set out of the holder. The lower contacts are removed by removing the hex socket screw that secures it to the contactor assembly.

Contactor Closing Coil and Trip Coil: The contactor assemblies use either an electrically held or a magnetically held coil. The normal side contains a magnetically held coil. Service procedures are the same for either type of coil. If the closing coil or trip coil do not function when the appropriate voltage (indicated on the side of the coil) is applied, replace the coil assembly.

NOTE: The closing coil and trip coil cannot be checked with an ohmmeter due to a rectifier circuit contained inside the sealed coil assembly.

The coil assembly does not have adequate clearance to slide out when the transfer switch assembly is installed. Remove the transfer switch mounting bolts and move the assembly out until clearance for removing the coil assembly is obtained. To remove the coil assembly, press in on the orange button on the side of the coil assembly (Figure 5-3), and slide the assembly out of the contactor assembly. Reinstall the coil assembly by holding in on the orange button while inserting the coil assembly into the contactor assembly.

Mechanical Interlock Service

The mechanical interlock prevents the Normal and Emergency power sources from closing at the same time. If the mechanical interlock does not function properly, replace the mechanical interlock.

ELECTRONIC CONTROL CIRCUIT BOARD

The electronic control circuit board (A1) is not field repairable. On some models of the RST, the relays A1-K1 and A1-K2 are socketed for service replacement.

Before replacing the electronic control circuit board, check each of the connectors for continuity and verify that the control is receiving the proper inputs. In most cases problems related to the electronic control are the result of a poor connection.

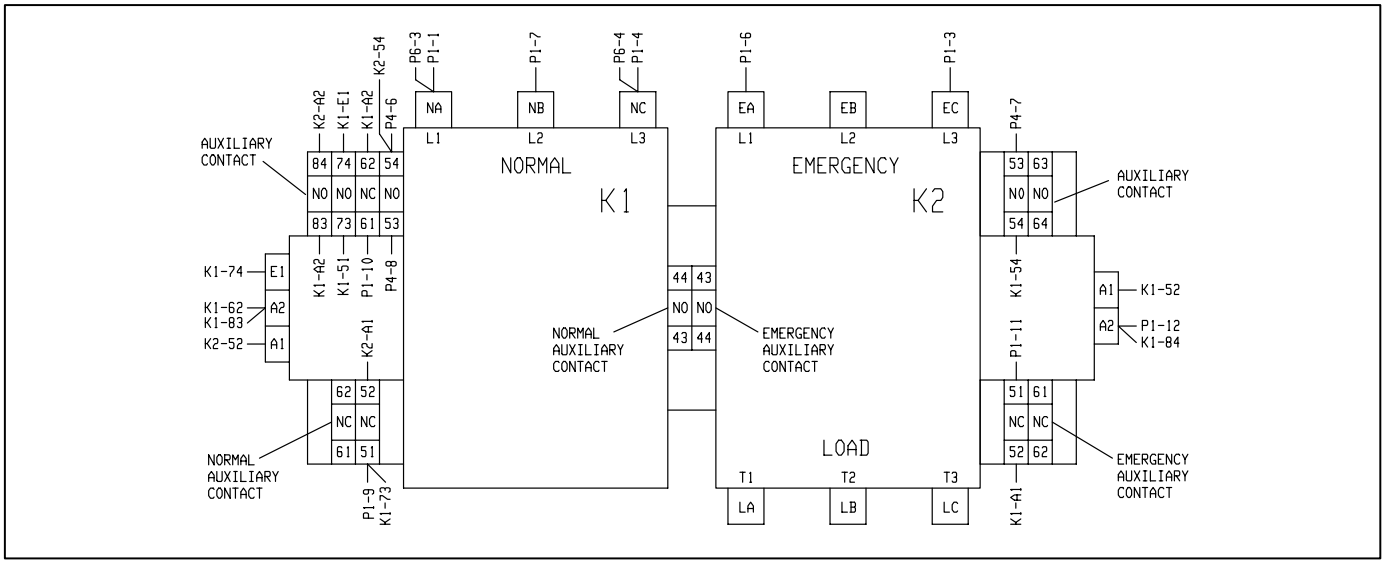


FIGURE 5-5. 100 AND 200 AMP CONTACTOR WIRING

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Prior to opening the panel door, follow the procedure on page 5-1 for disconnecting the AC power.

⚠WARNING ***AC power within the cabinet presents an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC power from the transfer panel before servicing.***

To access the electronic control circuit board for service, open the cabinet door, disconnect the J1/P1 connector and remove the electronic control circuit board cover. The circuit board is secured by additional screws and will not come out when the cover mounting screws are removed.

Relay A1-K1 and A1-K2 Service: Move the wire relay retainer to the side of the relay and pull the relay out of the socket. The relay has a 12VDC coil that can be checked by applying voltage to it. If the coil or contacts are defective, install a new relay in the socket and secure with the wire retainer.

Some models of the RST may have relays that are soldered in. If this is the case, and the relay is suspect, the board must be replaced.

Electronic Control Circuit Board Replacement: Carefully remove the connectors from the control. Make sure that all connectors are clearly marked for reconnection. Remove the mounting screws and remove the control board. Install new board and carefully reconnect all of the connectors.

Refer to Section 3, Adjustments and Settings for information on calibrating and adjusting the electronic control board.

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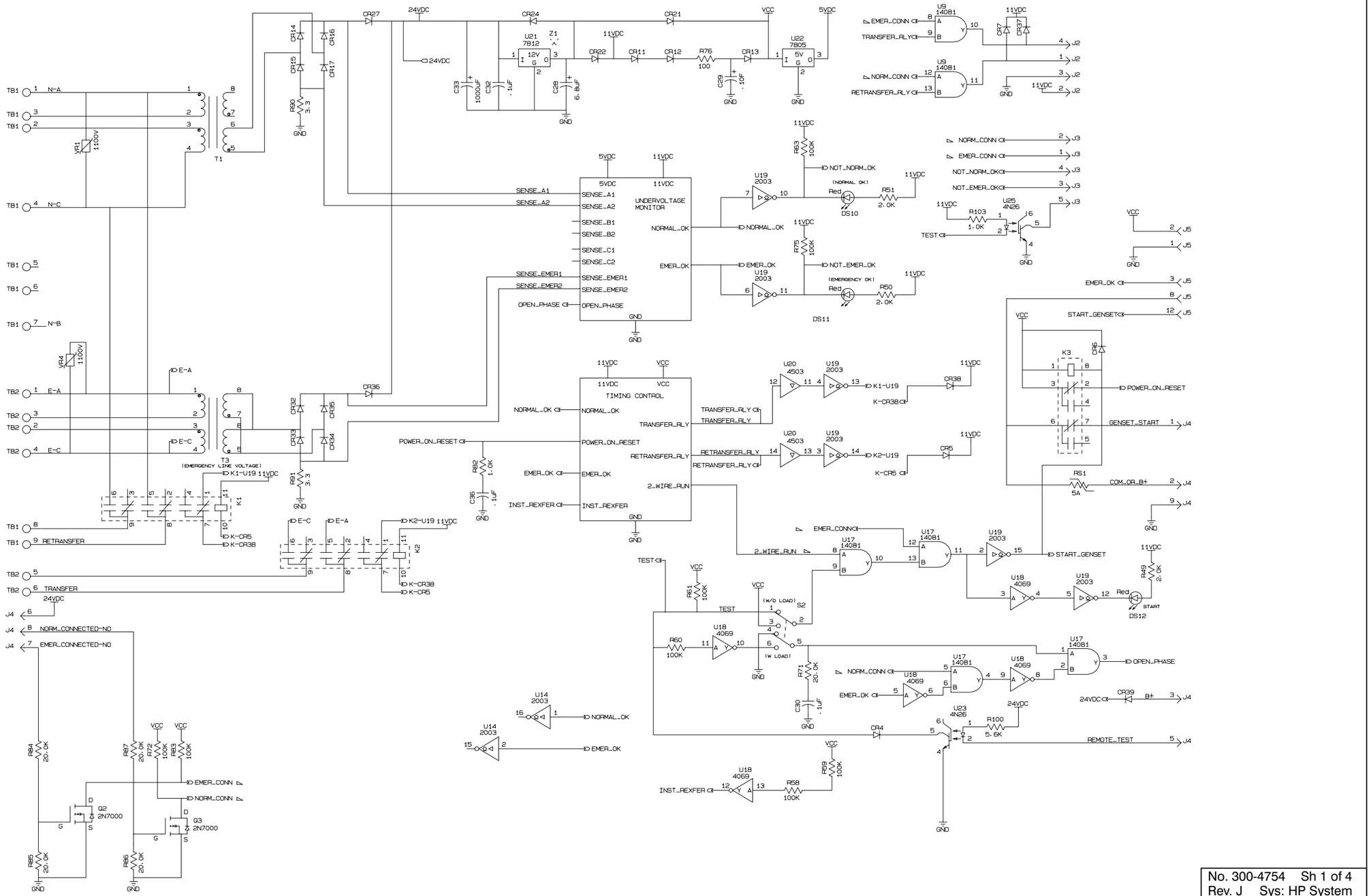
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6. Schematics/Wiring Diagrams

SCHEMATICS/WIRING DIAGRAMS **PAGE**

Control Board (Control Package A) 300-4754 6-2
Control Board (Control Package B) 300-4750 6-3
Typical 60-Amp Switch − Sheet 1 of 5 6-4
Typical 60-Amp Switch − Sheet 2 of 5 6-5
Typical 60-Amp Switch − Sheet 3, 4 of 5 6-6
Typical 60-Amp Switch − Sheet 5 of 5 6-7
Typical 100 and 200-Amp Switch − Sheet 1 of 5 6-8
Typical 100 and 200-Amp Switch − Sheet 2 of 5 6-9
Typical 100 and 200-Amp Switch − Sheet 3, 4 of 5 6-10
Typical 100 and 200-Amp Switch − Sheet 5 of 5 6-11

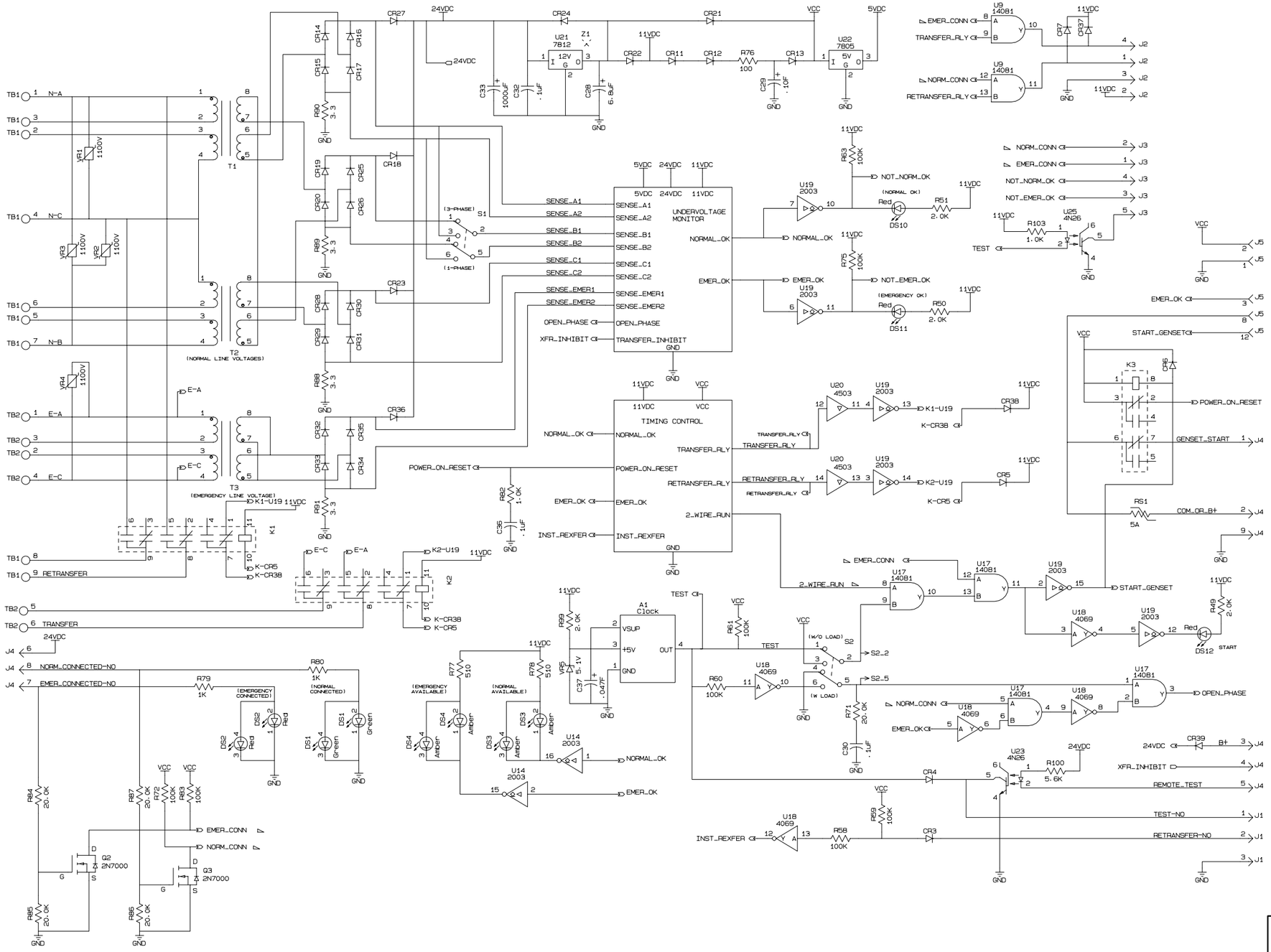
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FIGURE 6-1. CONTROL BOARD (CONTROL PACKAGE A) 300-4754

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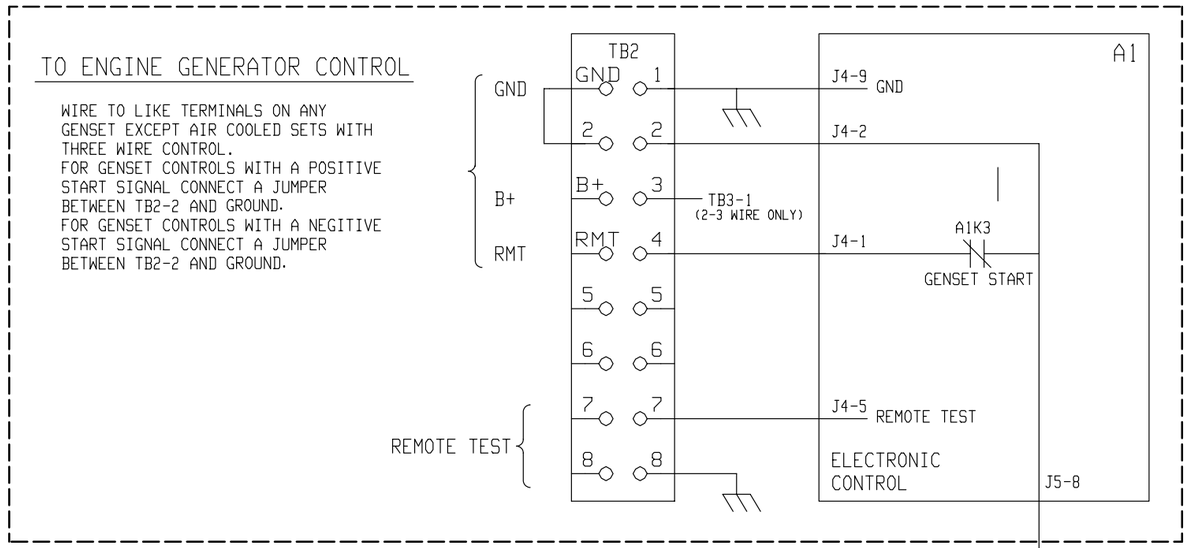
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FIGURE 6-2. CONTROL BOARD (CONTROL PACKAGE B) 300-4750

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**THIS IS A REPRESENTATIVE (GENERIC SCHEMATIC / WIRING DIAGRAM.
FOR TROUBLESHOOTING, REFER TO THE 5-SHEET SCHEMATIC AND WIRING DIAGRAM PACKAGE THAT WAS SHIPPED WITH THE TRANSFER PANEL.**

CUSTOMER CONNECTIONS



FEATURES:

BASE CONTROL
30-60 AMP
3 POLE
CONTACTOR LATCHED NORMAL SIDE
120 VOLT 1 PHASE
240 VOLT 1 PHASE
2 AMP BATTERY CHARGER

OPTIONS:

2-3 WIRE CONVERTER

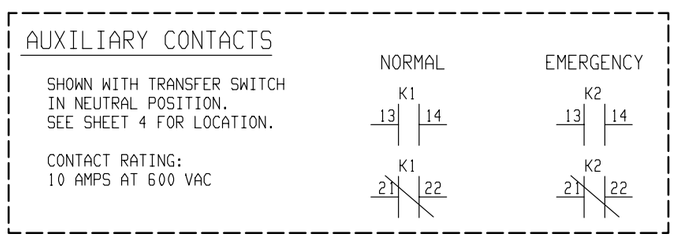


FIGURE 6-2. TRANSFER PANEL WIRING DIAGRAM (60 AMP)

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NOTES:

4. ALL COMPONENTS ARE SHOWN DE-ENERGIZED.
5. FOR SINGLE PHASE UNITS:
 120/240, 3 WIRE-CONNECT POWER CABLES TO A AND C
 120 L-N, 2 WIRE-CONNECT POWER CABLES TO A AND NEUTRAL

⚠7 A JUMPER IS CONNECTED BETWEEN TB2-2 AND TB2-3 WHEN USED WITH A GENSET WITH A POSITIVE START SIGNAL. A JUMPER IS CONNECTED BETWEEN TB2-2 AND TB2-1 WHEN USED WITH A GENSET WITH A NEGITIVE START SIGNAL.

LEGEND:	
K1(CC)	NORMAL CLOSING COIL
K1(TC)	NORMAL TRIP COIL
K2(CC)	EMERGENCY CLOSING COIL
K2(TC)	EMERGENCY TRIP COIL

THIS IS A REPRESENTATIVE (GENERIC SCHEMATIC / WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE 5-SHEET SCHEMATIC AND WIRING DIAGRAM PACKAGE THAT WAS SHIPPED WITH THE TRANSFER PANEL.

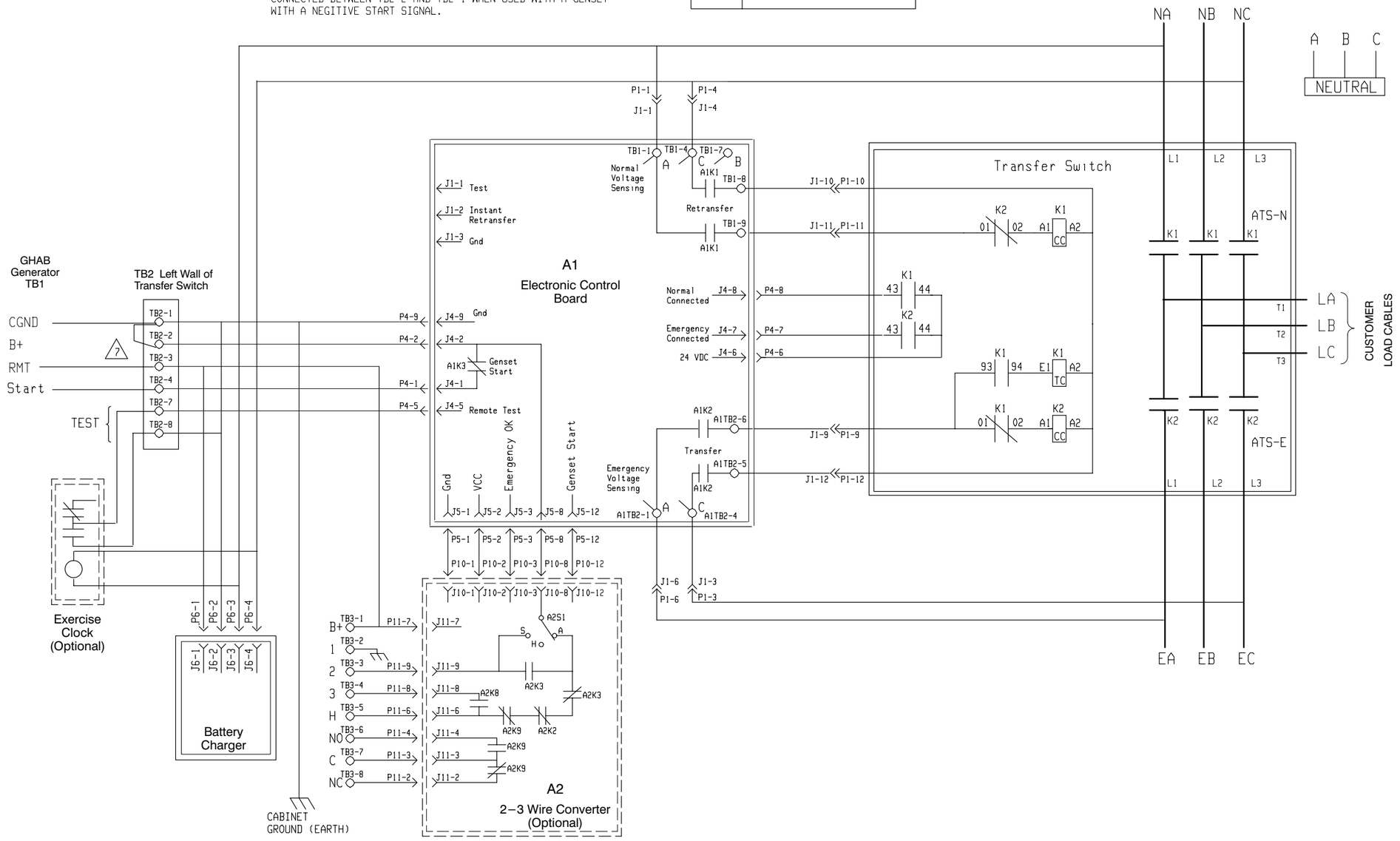
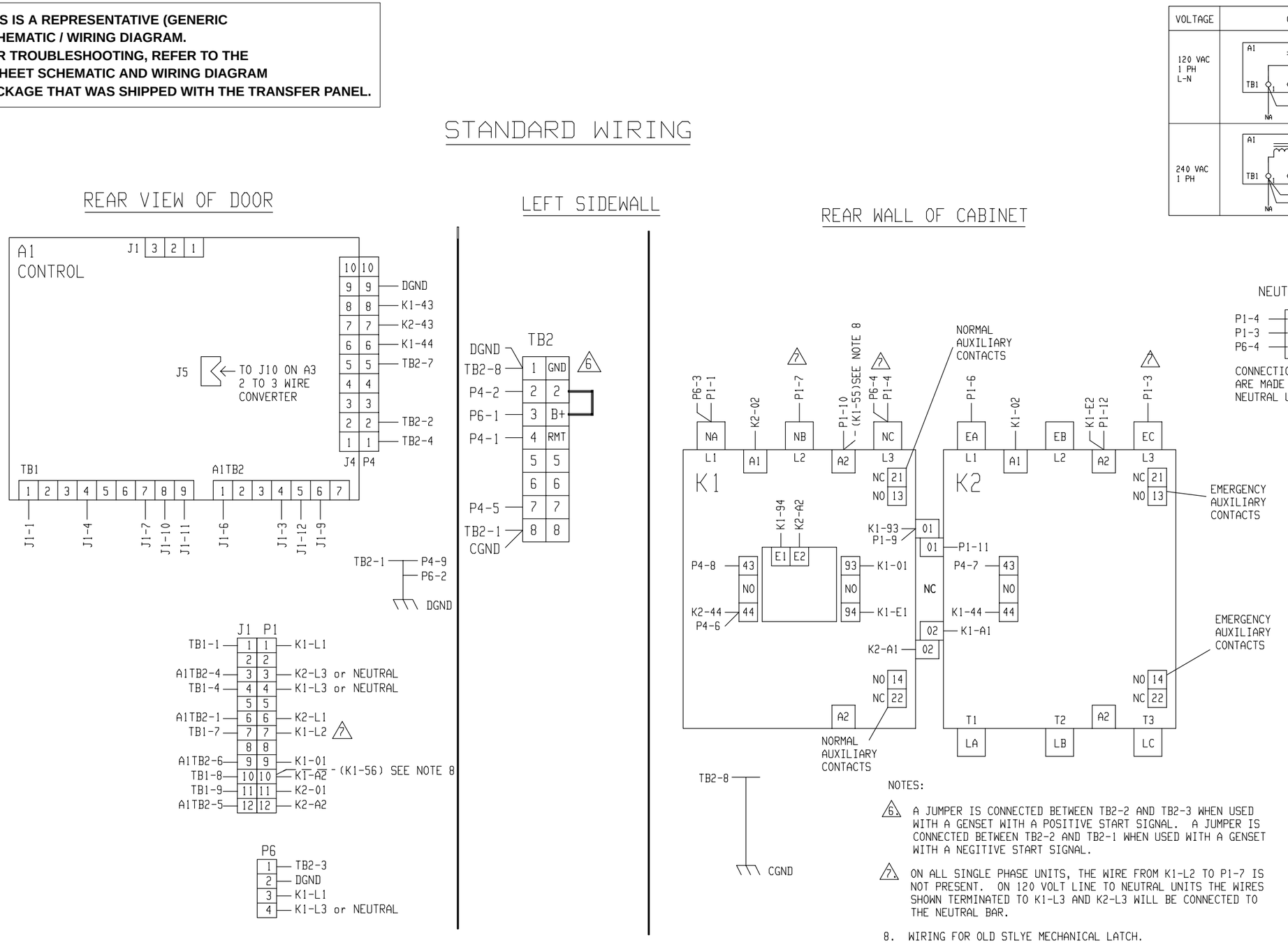


FIGURE 6-3. TRANSFER PANEL WIRING DIAGRAM (60 AMP)

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STANDARD WIRING



NOTES:

6. A JUMPER IS CONNECTED BETWEEN TB2-2 AND TB2-3 WHEN USED WITH A GENSET WITH A POSITIVE START SIGNAL. A JUMPER IS CONNECTED BETWEEN TB2-2 AND TB2-1 WHEN USED WITH A GENSET WITH A NEGITIVE START SIGNAL.

7. ON ALL SINGLE PHASE UNITS, THE WIRE FROM K1-L2 TO P1-7 IS NOT PRESENT. ON 120 VOLT LINE TO NEUTRAL UNITS THE WIRES SHOWN TERMINATED TO K1-L3 AND K2-L3 WILL BE CONNECTED TO THE NEUTRAL BAR.

8. WIRING FOR OLD STLYE MECHANICAL LATCH.

FIGURE 6-4. TRANSFER PANEL WIRING DIAGRAM (60 AMP)

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OPTION WIRING

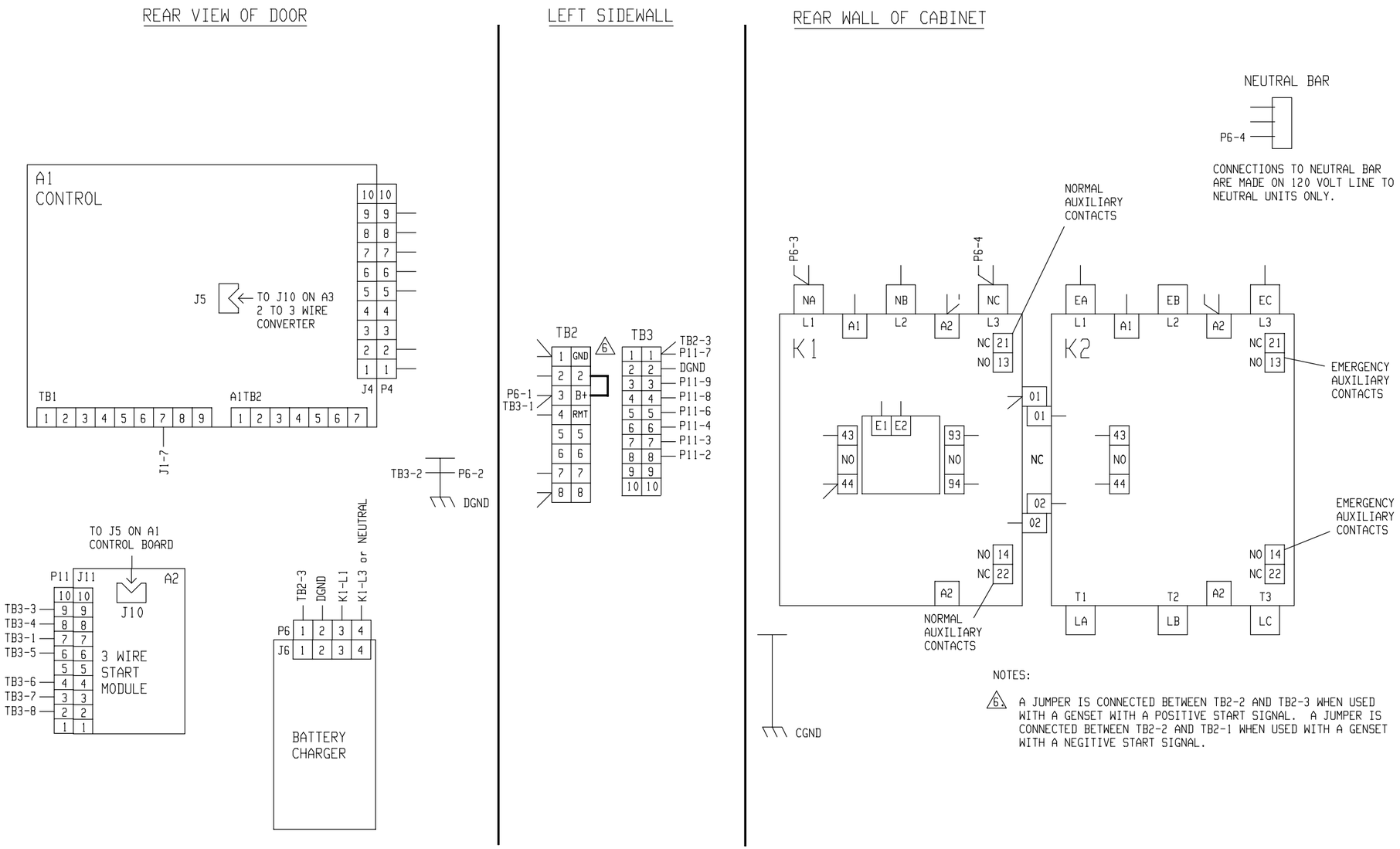
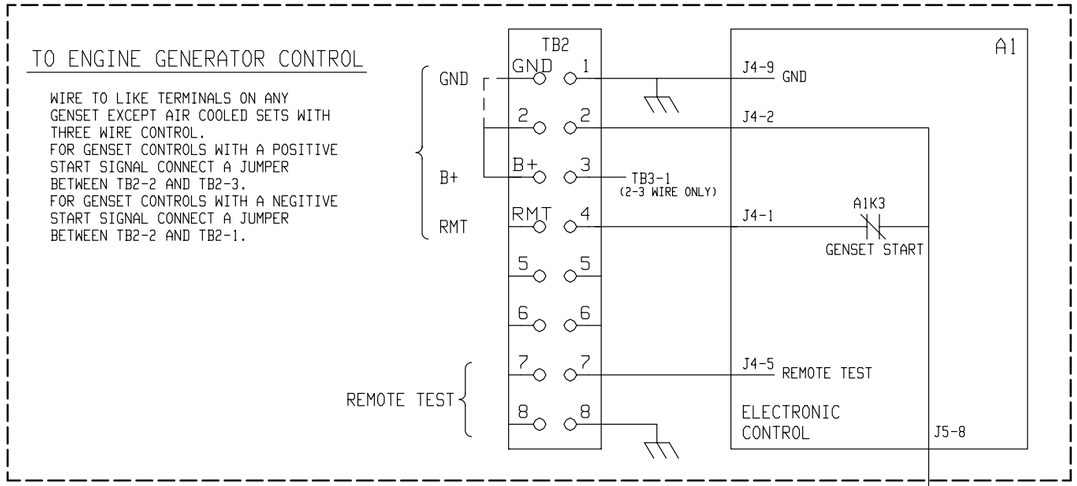


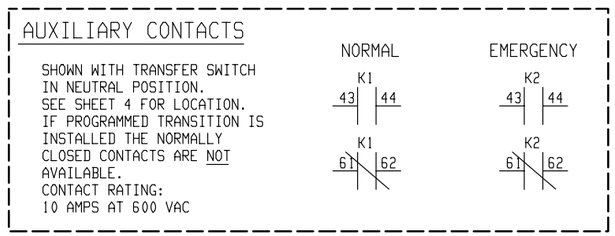
FIGURE 6-5. TRANSFER PANEL WIRING DIAGRAM (60 AMP)

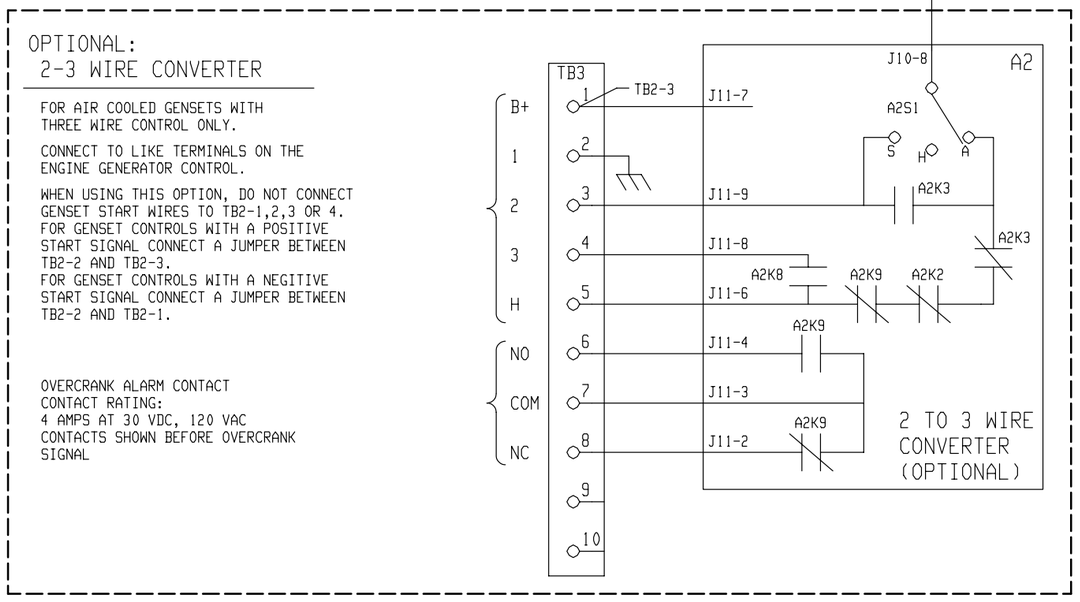
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CUSTOMER CONNECTIONS







FEATURES:

BASE CONTROL
100-260 AMP
3 POLE
CONTACTOR LATCH NORMAL SID
120 VOLT 1 PHASE
240 VOLT 1 PHASE
2 AMP BATTERY CHARGER

OPTIONS:

2-3 WIRE CONVERTER

FIGURE 6-6. TRANSFER PANEL WIRING DIAGRAM (100 & 200 AMP)

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NOTES:

4. ALL COMPONENTS ARE SHOWN DE-ENERGIZED.
5. FOR SINGLE PHASE UNITS:
 120/240, 3 WIRE-CONNECT POWER CABLES TO A AND C
 120 L-N, 2 WIRE-CONNECT POWER CABLES TO A AND NEUTRAL

⚠7 A JUMPER IS CONNECTED BETWEEN TB2-2 AND TB2-3 WHEN USED WITH A GENSET WITH A POSITIVE START SIGNAL. A JUMPER IS CONNECTED BETWEEN TB2-2 AND TB2-1 WHEN USED WITH A GENSET WITH A NEGITIVE START SIGNAL.

LEGEND:	
K1(CC)	NORMAL CLOSING COIL
K1(TC)	NORMAL TRIP COIL
K2(CC)	EMERGENCY CLOSING COIL
K2(TC)	EMERGENCY TRIP COIL

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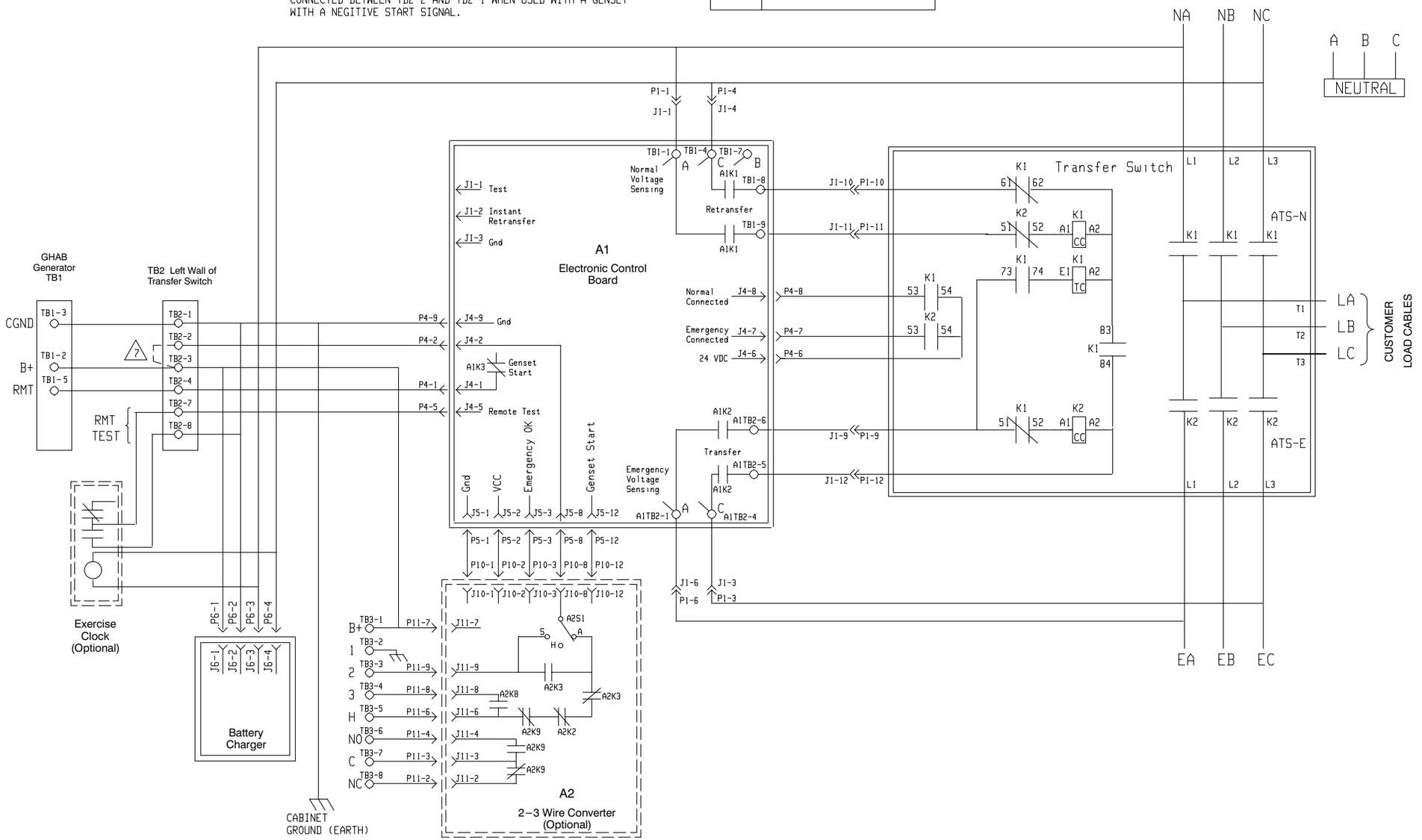
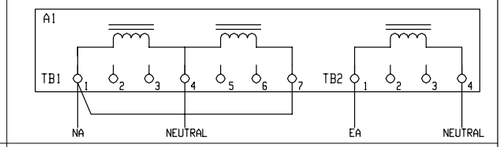
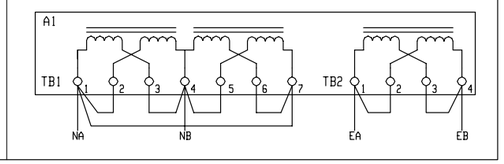


FIGURE 6-7. TRANSFER PANEL WIRING DIAGRAM (100 & 200 AMP)

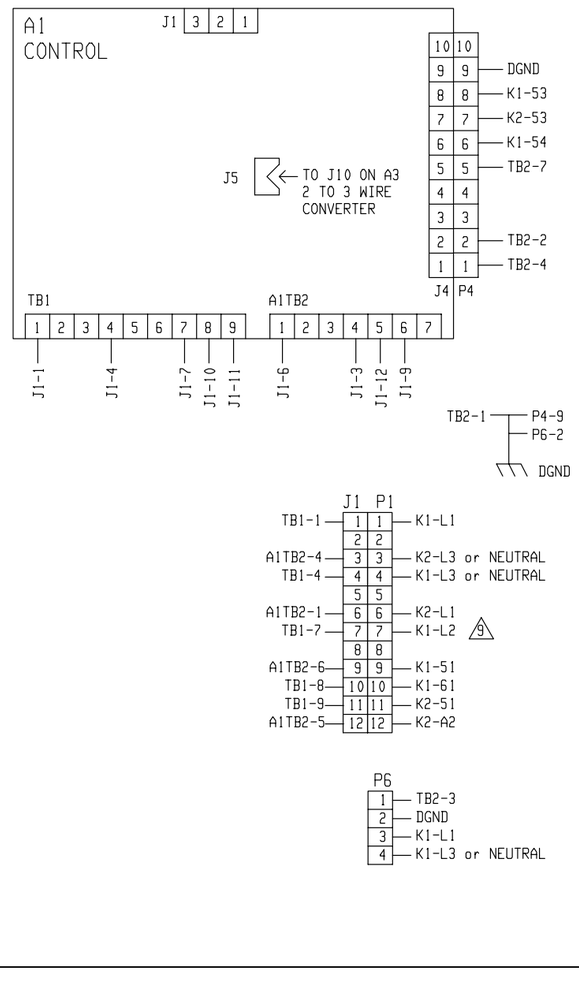
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FOR TROUBLESHOOTING, REFER TO THE 5-SHEET SCHEMATIC AND WIRING DIAGRAM PACKAGE THAT WAS SHIPPED WITH THE TRANSFER PANEL.**

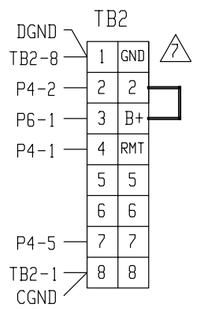
STANDARD WIRING

VOLTAGE	CONTROL TRANSFORMER CONNECTIONS
120 VAC 1 PH L-N	
240 VAC 1 PH	

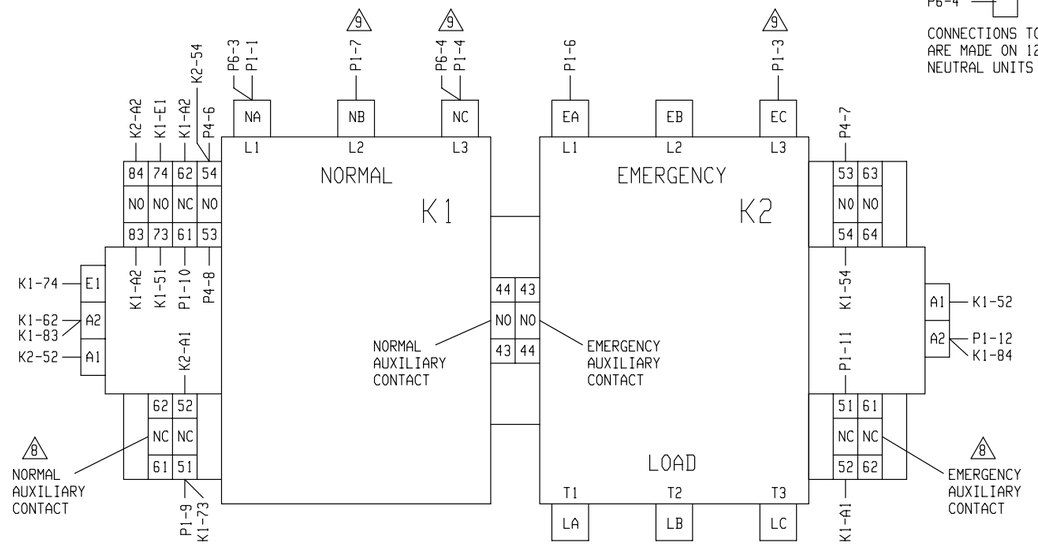
REAR VIEW OF DOOR



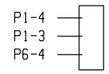
LEFT SIDEWALL



REAR WALL OF CABINET



NEUTRAL BAR



CONNECTIONS TO NEUTRAL BAR ARE MADE ON 120 VOLT LINE TO NEUTRAL UNITS ONLY.

NOTES:

(7) A JUMPER IS CONNECTED BETWEEN TB2-2 AND TB2-3 WHEN USED WITH A GENSET WITH A POSITIVE START SIGNAL. A JUMPER IS CONNECTED BETWEEN TB2-2 AND TB2-1 WHEN USED WITH A GENSET WITH A NEGITIVE START SIGNAL.

(8) THIS AUXILIARY CONTACT IS NOT AVAILABLE WHEN PROGRAMMED TRANSITION IS INSTALLED. SEE SHEET 5

(9) ON ALL SINGLE PHASE UNITS, THE WIRE FROM K1-L2 TO P1-7 IS NOT PRESENT. ON 120 VOLT LINE TO NEUTRAL UNITS THE WIRES SHOWN TERMINATED TO K1-L3 AND K2-L3 WILL BE CONNECTED TO THE NEUTRAL BAR.

FIGURE 6-8. TRANSFER PANEL WIRING DIAGRAM (100 & 200 AMP)

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OPTION WIRING

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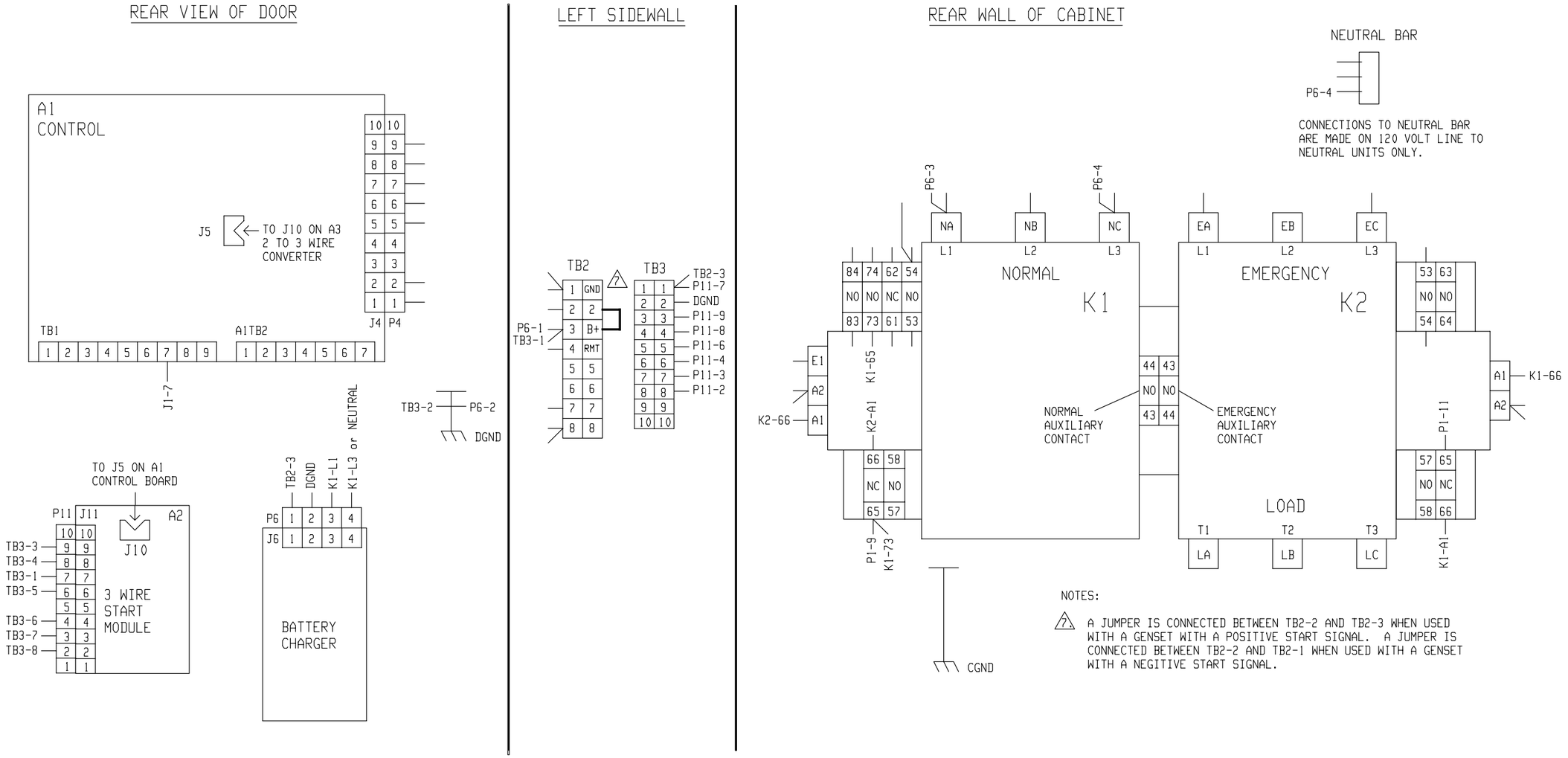


FIGURE 6-9. TRANSFER PANEL WIRING DIAGRAM (100 & 200 AMP)

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